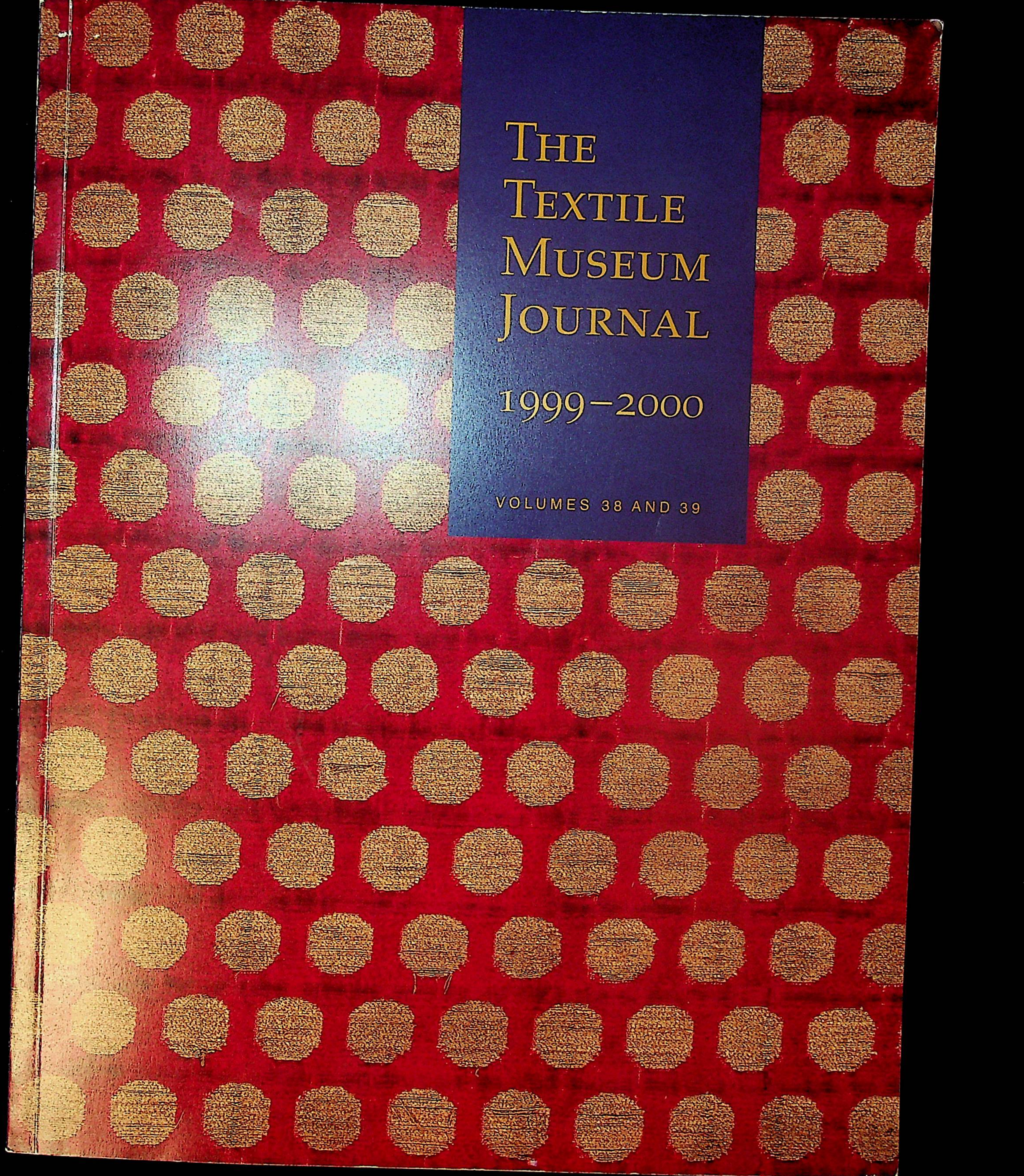

The Textile Museum Journal

1999–2000

VOLUMES 38 AND 39

Contributors

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Front cover: Detail of velvet (front). Cooper-Hewitt, National Design Museum, Smithsonian Institution, 1902–1–385, gift of J. P. Morgan. Art Resource, New York. Photo by Matt Flynn. See Sonday, p. 101, fig. 1 (left).

Back cover: Detail of velvet (back). Cooper-Hewitt, National Design Museum, Smithsonian Institution, 1902–1–385, gift of J. P. Morgan. Art Resource, New York. Photo by Matt Flynn. See Sonday, p. 101, fig. 1 (right).

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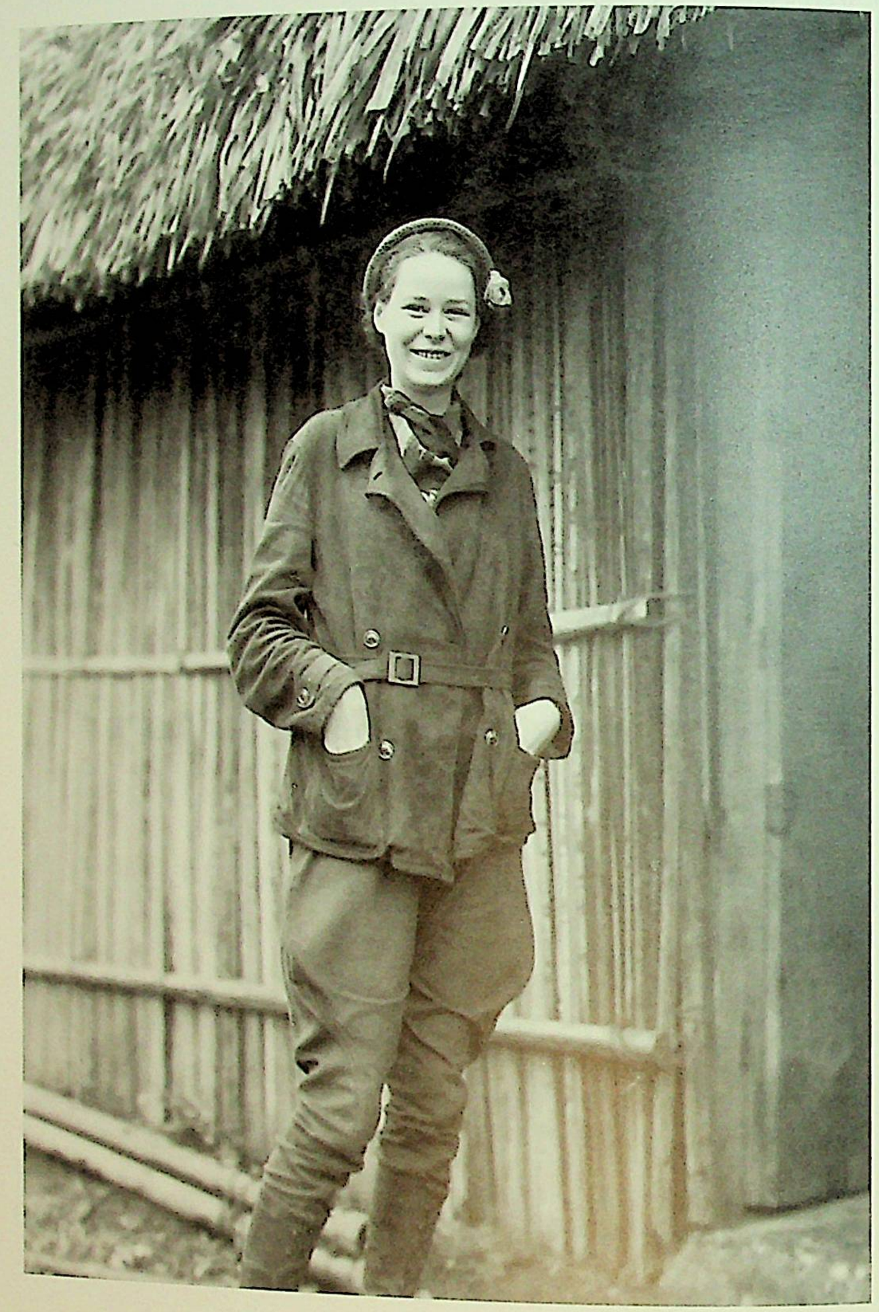


Marion Stirling in 1939 at the camp of Tres Zapotes, Veracruz where the Stirlings found the first of the great Olmec heads. Photo by Richard Hewitt Stewart.

Marion Stirling Pugh (1911-2001)

The Textile Museum has lost a Trustee who shaped the direction of the Museum for over thirty years and who was the last direct link to the Museum's founder, George Hewitt Myers. Profoundly interested in the art and history of weaving, Marion Pugh was a Trustee of The Textile Museum from 1968, serving as Secretary, Treasurer, Vice President, and President.

Marion was just shy of her 90th birthday when she died in Tucson after an extraordinarily productive life that saw continuing accomplishment in a variety of scholarly disciplines ranging from archaeology to geography.

She was born Marion Illig on May 12, 1911, in Middletown, New York, the daughter of Louis and Lena Randall Illig. In 1930, Marion received her BS degree from Rider College, and afterward moved to Washington, DC, where she attended George Washington University from 1931 to 1933. During this time Marion also worked at the Smithsonian Institution's Bureau of American Ethnology as secretary to Matthew W. Stirling, Director of the Bureau. On December 11, 1933, Marion and Matthew were married.

Together the Stirlings shared a career of archaeological adventure and discovery, beginning with a series of joint National Geographic Society-Smithsonian Institution expeditions to explore the little-known ruins of Mexico's Gulf Coast regions between 1938 and 1946. These journeys by Marion, Matthew, and National Geographic photographer Richard Hewitt Stewart took place mainly by boat and horseback through the humid rain forests of Veracruz and Tabasco states. Despite the physical difficulties, the expeditions proved successful beyond all expectations, for they revealed and recorded a truly lost civilization—the Olmec, producers of the famed colossal heads of stone and other remains, dated to around the beginning of the first millennium B.C., that proved it to be one of the earliest high cultures in all of the Americas.

From the Mexican work the Stirlings and Stewart moved on to other areas of the hemisphere, including Ecuador, Panama, and Costa Rica. The results of these expeditions appeared regularly as articles by Marion, Matthew, or both in the *National Geographic Magazine, Américas,* and other journals. In 1941, Marion shared with Matthew the prestigious Franklin L. Burr Award of the National Geographic Society.

Marion's ever-broadening interests are reflected in her memberships in the Association of American Geographers and the Society of Woman Geographers, where she served on the Executive Council in 1954, and as President, 1960-63 and 1969-72.

Matthew Stirling died in 1975. One of Marion's prized possessions was a silver pendant that Matthew had made for her in Mexico, embossed with a jaguar mask on the obverse and the date of a stele whose date she decoded on the reverse.

In 1979 Marion married Major General John Ramsey Pugh, the son-in-law of George Hewitt Myers, who was active himself in the work of The Textile Museum. Together they made their home at Little Fiddlers Green, General Pugh's family estate in Round Hill, Virginia. They updated this stone house dating from 1770 to pursue their interests, building a library for their books and memorabilia, and a lap swimming pool.

Marion's interest in Mexican textiles led her to establish the Mexican Research Fund at The Textile Museum for the purchase of textiles for the collection. She both contributed to this fund and also asked that gifts in expression of sympathy on the death of Matthew Stirling be made to it. In 1979, General and Mrs. Pugh broadened the scope of the fund and it was accordingly renamed the Latin American Research Fund. Marion endowed this fund in December 1993. The fund has been the Museum's only source of purchase funds for textiles in this area, making possible many significant additions to the collections from Guatemala, Ecuador, Peru, and Bolivia as well as Mexico. Purchases have been made of material collected in the field in the course of textile research in each of these countries and outstanding examples offered by dealers. Marion also supported other Western Hemisphere Department projects such as fieldwork by curator Ann Rowe in Ecuador, and a forthcoming publication on Q'ero textiles from the Cuzco area of Peru.

Art and adventure were Marion's pursuits. We do well to follow in her footsteps.

Ursula E. McCracken
Director, The Textile Museum

George E. Stuart
Center for Maya Research

A Group of Possibly Thirteenth-Century Velvets with Gold Disks in Offset Rows

Milton Sonday

A provocative question from two colleagues—"What do we know about thirteenth-century Persian velvet?"—initiated the research that led to this paper. I began to respond seriously upon learning which velvet had prompted the question and what other researchers' opinions had been. A report that I assumed would be straightforward on what could be a very rare fabric quickly grew into an all-consuming project.[1] It soon became obvious that the first example I studied belonged to a large and tightly related group. Numerous variations within the group, however, forced me to deal with concepts fundamental to pattern weaving, the weaving of velvet in general, and various details concerning the weaving of individual textiles within the group. Consequently, this presentation focuses on conceptual and detailed aspects of the structure and techniques of the velvets in question. For date and attribution, I have relied upon published works relevant to the period in which these velvets may have been woven.

The velvets that make up this group are patterned with gold disks in offset rows; the disks are nestled within voided areas of cut pile. The disks illustrated in figures 1 and 2 are about 1.2 cm wide and the surrounding cut pile is red. This group of velvets has traditionally been dated to the fifteenth and sometimes to the fourteenth century. Most have been called Italian, others Spanish, and one attributed to regions east of the Mediterranean.[2] A thirteenth-century date and a non-European attribution has been proposed by Anne Wardwell and Lisa Monnas, but little has been said about how the pattern was woven (Wardwell 1988–89; Monnas 1993). Wardwell (1988–89, p. 111), writing about Eastern Islamic silks of the thirteenth and fourteenth

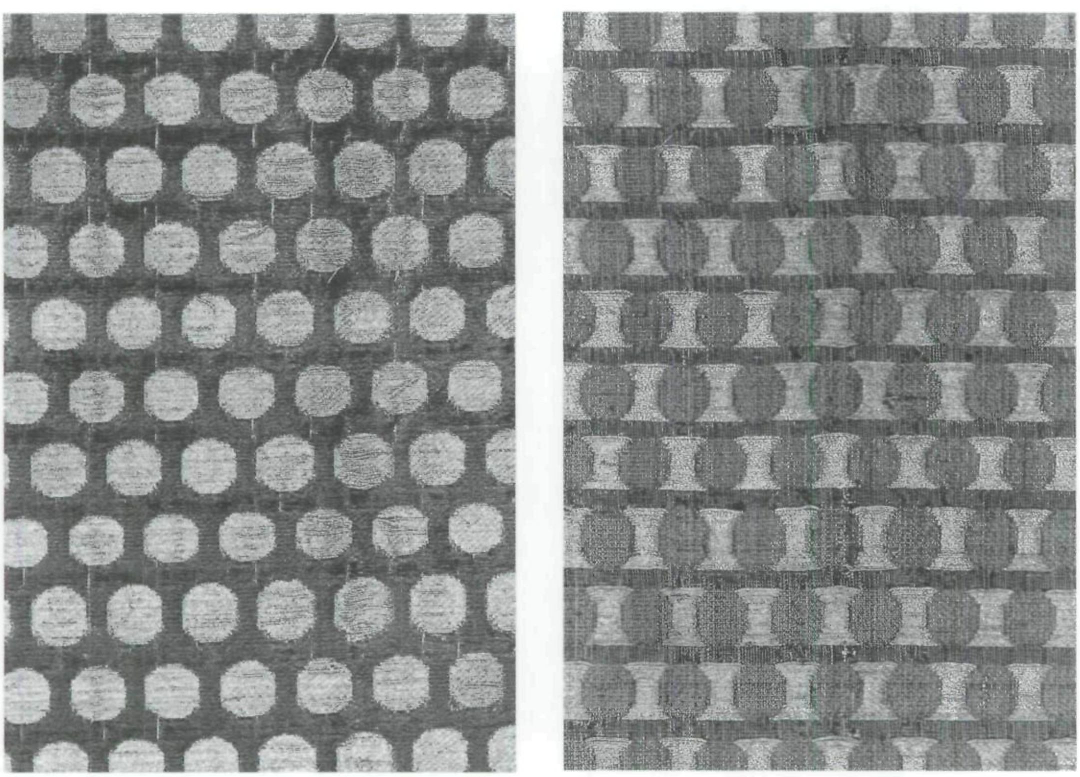


Fig. 1. Front (left) and back (right) of velvet patterned with gold disks in offset rows surrounded by cut pile. The section illustrated measures 21 cm warp x 15 cm weft. The width of each disk is about 1.2 cm. Cooper-Hewitt, National Design Museum, Smithsonian Institution, New York 1902–1–385, Gift of J. P. Morgan. Art Resource, New York. Photo by Jill Bloomer.

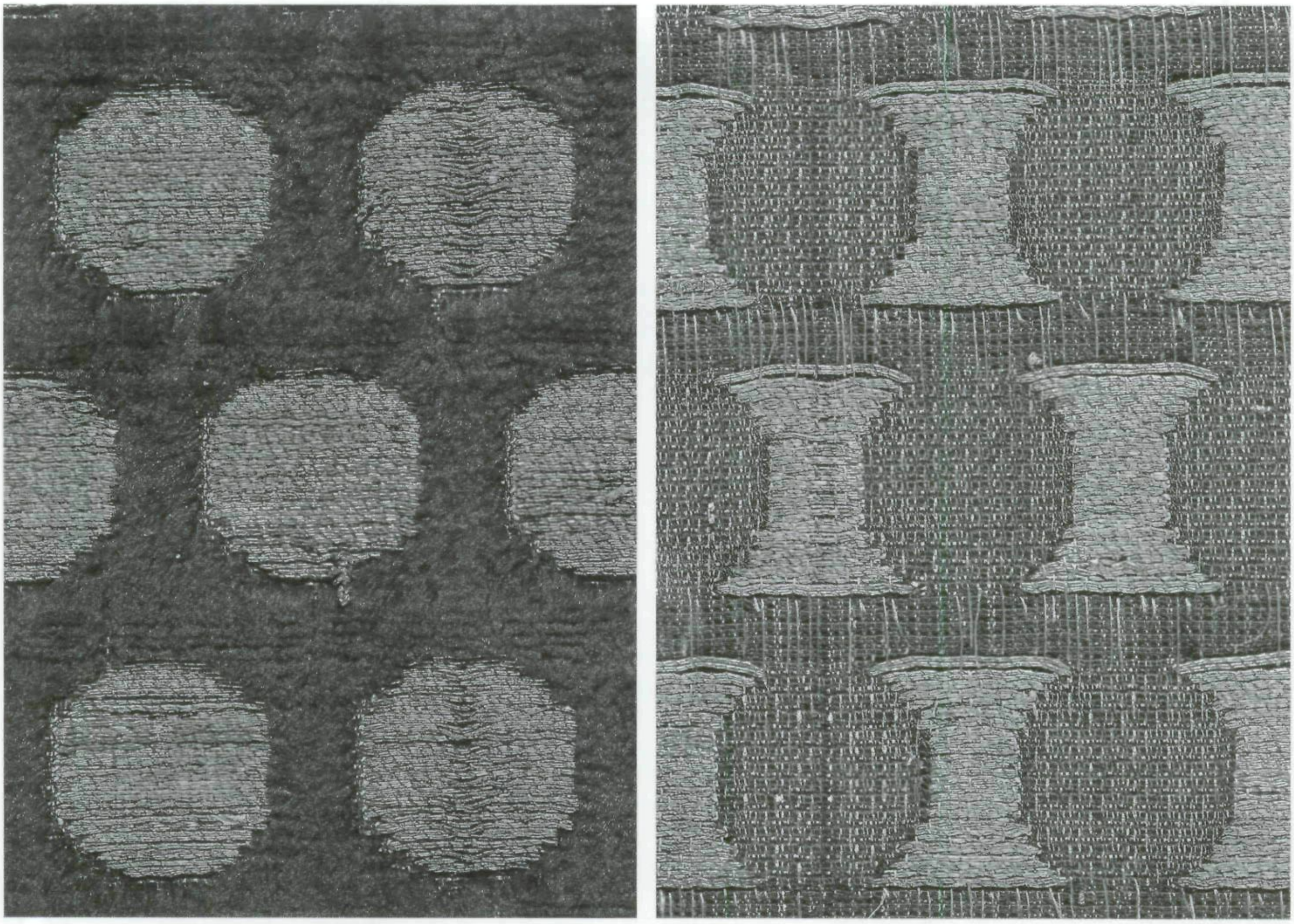


Fig. 2. Detail of the front (left) and back (right) of the velvet shown in figure 1. Section shown measures 6.5 cm. warp x 4.5 cm weft.

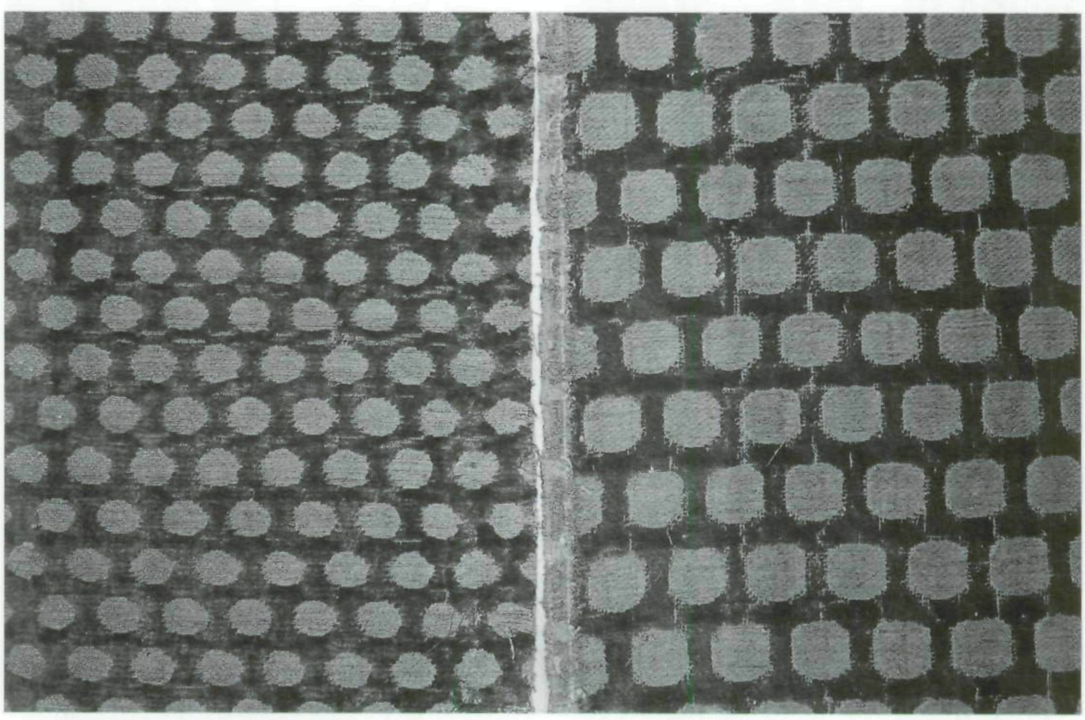
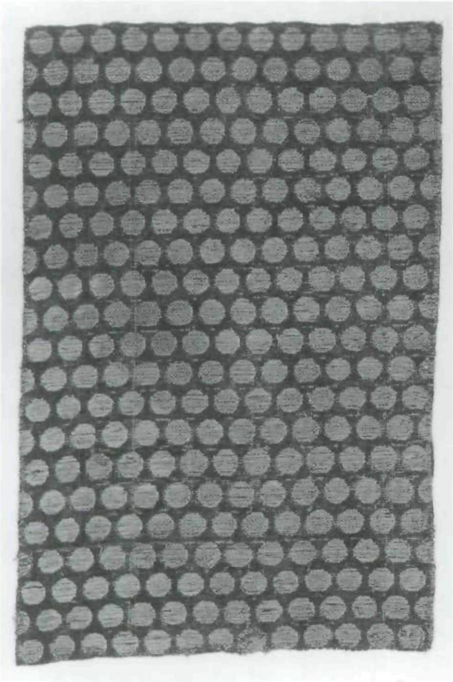
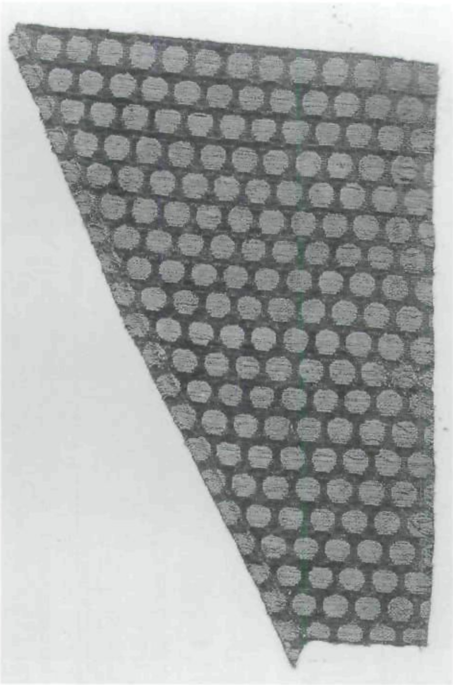


Fig. 3. Two pieces in the collection of the Koninklijke Musea voor Kunst en Geschiedenis, Brussels, from the Errera Collection: (left) TX 465, disks 1.1 cm wide, (right) TX 464, disks 1.4 cm wide; note side finish. Photo by Chris Verhecken-Lammens, courtesy of the Koninklijke Musea voor Kunst en Geschiedenis, Brussels.





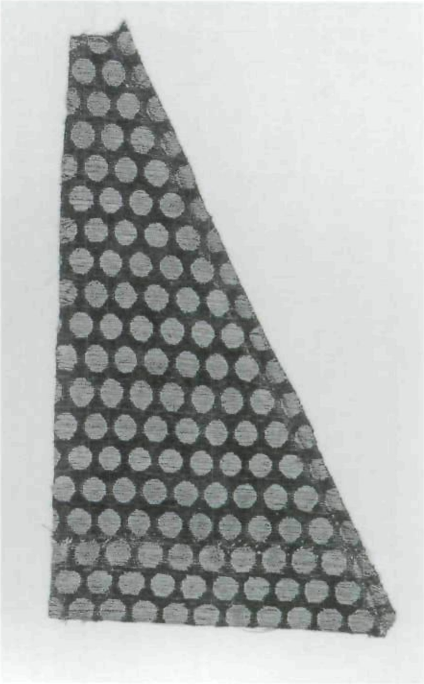


Fig. 4. Three pieces in the Cleveland Museum of Art, from left to right: 1918.225, 1918.30a, 1918.30b. A small strip is sewn to the bottom edge of 1918.30b. Disks of all pieces are slightly wider than 1 cm. The Cleveland Museum of Art, 2001, Dudley P. Allen Fund.

centuries, says: "There is no question that textiles with this pattern were produced in the late thirteenth and fourteenth centuries because they are described in the 1295 inventory of Boniface VIII, the 1311 inventory of Clement V, and the inventory in 1341 of the church of San Francesco in Assisi." Wardwell refers to a painting by Simone Martini that is the subject of an article by Lisa Monnas (1993). Now in the Museo Nazionale di Capodimonte in Naples, it was executed in 1317, perhaps for Santa Chiara in Naples. Monnas (p. 166) begins by saying that "it shows St. Louis of Toulouse enthroned, receiving a heavenly crown from two angels hovering above his head, whilst simultaneously conferring the crown of Naples upon his kneeling brother, Robert of Anjou." St. Louis is shown wearing a cope patterned with offset rows of gold disks in the main scene, as well as in one of the five smaller scenes below, in which he is shown on his death bed (see color plate, p. 105). Monnas remarks that St. Louis's cope "looks to have been closely observed from real cloth" and suggests as a model one of the velvets in the group in the collection of the Victoria and Albert Museum, her figure 8, saying: "the artist has carefully imitated the stepped effect of the weave, transforming circles into octagons" (p. 170). The pattern has also been noted on the dress of Salomé in a fourteenth-century mosaic in St. Mark's basilica, Venice (Davanzo Poli 1995, no. 83, p. 101). In a painting by Andrea Orcagna in the Galleria degli Uffizi, Florence—a commission awarded around 1367—the pattern fills four small roundels, two set into the top of each of the wings of the triptych (Sangiorgi 1920, p. 117).

A surprisingly large number of actual examples of such velvets survive and more may yet be found.[3] Notable among them are the chasuble in the Art Institute of Chicago (Mayer-Thurman 1975, no. 44, p. 130), a chasuble in the Musée de Tissus, Lyon (Cox 1900, pl. XXX), and a 234-cm long textile, with full selvedge-to-selvedge width, in the Museo Nazionale del Bargello, Florence. The actual number of fragments or lengths is larger than the number of accessioned items because a given object may be composed of several pieces sewn together. For example, one in the Hispanic Society, New York (H954), is a patchwork of fifteen pieces, some of them tiny. Another in this institution (H955) is a patching together of four pieces, with two additional small pieces sewn to the back. Are the pieces, large and small, in these thirty collections from the same bolt of cloth? If not, might they be from the same loom?

That these velvets are not products of the same loom is clear when two velvets with disks different in size and configuration are placed side by side. Such is the case with the two pieces in Brussels (fig. 3).[4] The contours of the disks of these two pieces are different, much more so than with pieces in other collections. The three pieces in the Cleveland Museum of Art

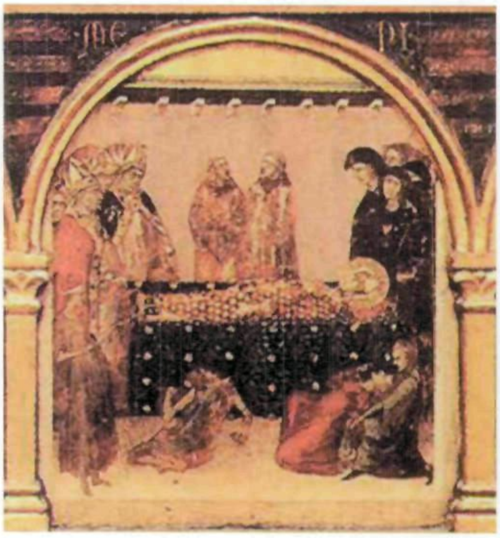
Collection	Disk width (cm)	Pile count/cm ↔ x ↕
Cleveland 1918.30b	1.1–1.2	17 x 8
Brussels TX 465	1.0–1.1	16 x 9
Cleveland 1918.225	1.1–1.2	16 x 9
Cleveland 1918.30a	1.1 –1.2	16 x 9
MMA 46.156.72	1.2	16 x 9
Private collection, London	1.2	16 x 9
Cleveland 1918.30c	1.2	16 x 9
Boston MFA 93.376	1.2	16 x 9
Private collection, London	1.2	16 x 8
Hispanic Society H955 (no.3)	1.3	15 x 11
Textile Gallery, London (no.1)	1.2	16 x 9
Cooper Hewitt 1902-1-385	1.2	15 x 10
V&A 545a-1884	1.3	15 x 10
V&A 545b-1884	1.3	15 x 10
Hispanic Society H955 (no.2)	1.3	14 x 11
Bargello F127 (no.1)	1.3–1.4	15 x 10
Brussels TX 464	1.4	15 x 11
Hispanic Society H954 (no.2)	1.4	15 x 11
Hispanic Society H955 (no.1)	1.4	15 x 10
Cooper Hewitt 1896-1-59	1.4	14 x 9
Stibbert, Florence	1.5	Not counted

Table I
Width of disks and pile counts.

(fig. 4), also photographed together, at first glance appear to be identical. Actually, there are four pieces: an additional small piece is sewn to the bottom of 1918.30b, which, for my purposes, I labeled "c". Visually determined differences among disks are difficult to establish when disks are not side by side. To facilitate comparisons, photographs must be taken at the same scale. The narrow range of disk widths and pile counts is shown in Table I. Ultimately, we must rely on technical features to identify those velvets woven on different looms and to propose some features of the loom or looms that might have been used.

This study, based on examples I have actually seen, includes those in collections in New York in the Cooper-Hewitt Museum, the Hispanic Society, and The Metropolitan Museum of Art; the Cleveland Museum of Art; the Museum of Fine Arts, Boston; the Victoria and Albert Museum; The Textile Gallery, London, and a private collection in London; Koninklijke Musea voor Kunst en Geschiedenis, Brussels; plus Museo Nazionale del Bargello and the Stibbert Museum, Florence.[5] Two in Italy are published (Buss and others 1983, pp. 130–31) with an analysis by Marina Milenelli.[6]

The discussion here follows the progress of my work on these velvets as I became increasingly involved, piece by piece. I did not follow a predetermined set of criteria for analysis. Only as I neared deadlines did I have a set of criteria—criteria that readers are free to use in order to continue research on this fascinating group of velvets.



Color plate. Detail of the predella of Altar of St. Louis of Toulouse, executed in 1317 by Simone Martini. St. Louis, shown on his deathbed, is wearing a cope patterned with offset rows of gold disks. Museo Nazionale di Capodimonte, Naples.

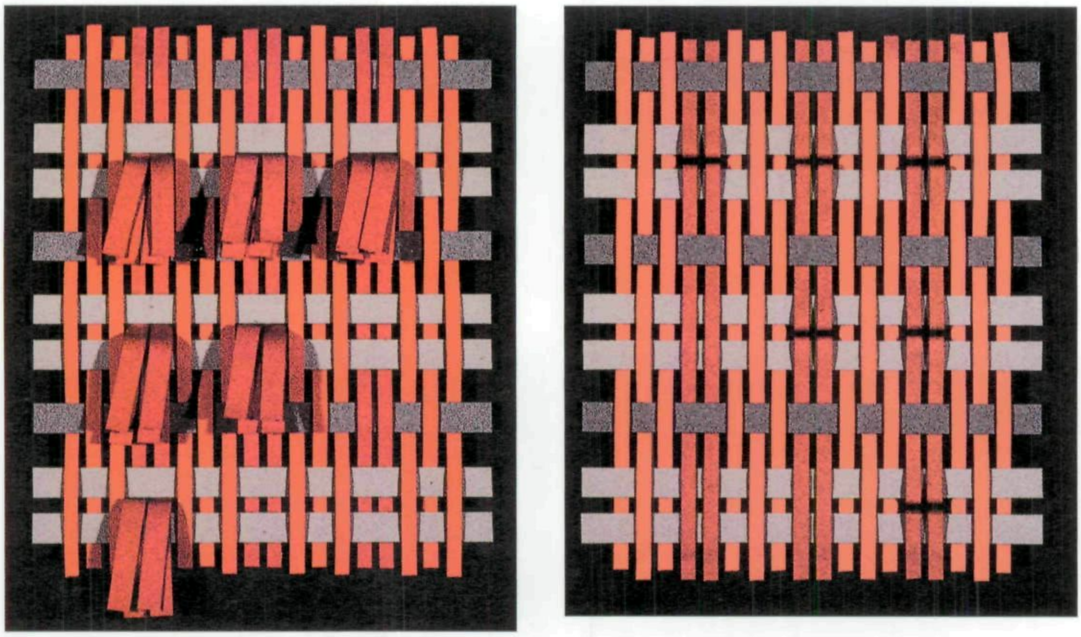


Fig. 5. Diagram of the front (left) and back (right) of the plain-weave foundation of the lampas/velvet. Every fourth warp of the set of warps of the plain weave is used for pile. Note the pairing of wefts in one shed of the plain weave that forms a vise for the pile warps pulled up between them. This weave, with pile, can be considered the foundation of a lampas.

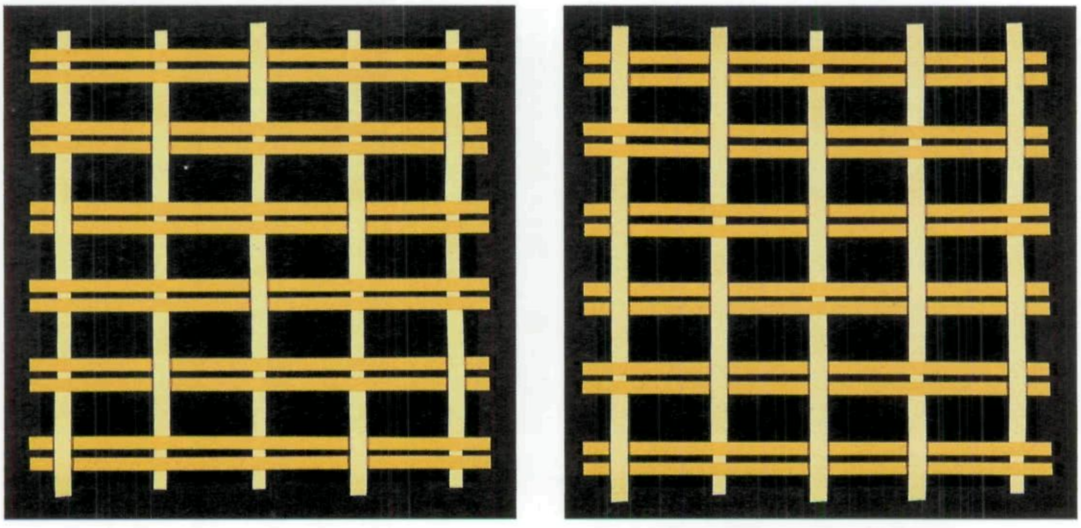


Fig. 6. The supplementary weave of the lampas/velvet: (left) weft-float face—a 1&2 Z-twill; (right) warp-float face—a 2&1 S-twill.

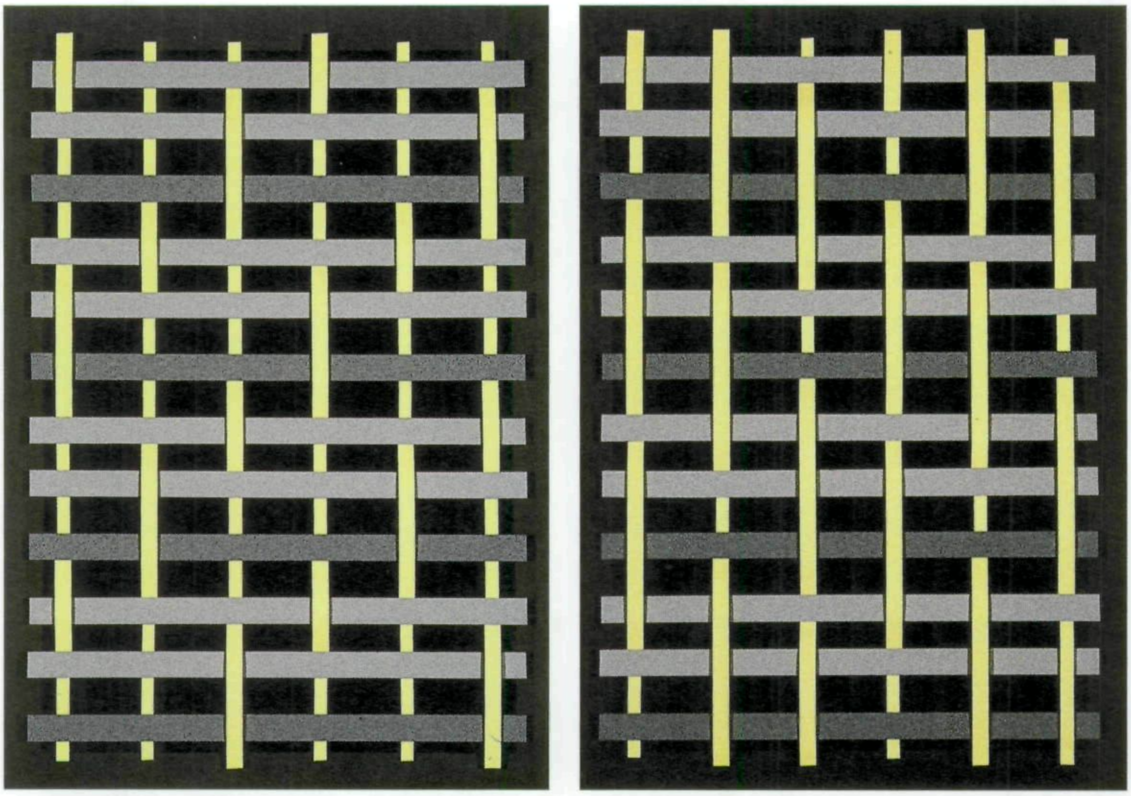


Fig. 7. The interlacing sequence of the set of warps of the twill with the set of wefts of the plain weave—the means by which the two weaves of the lampas are connected. Note that this interlacing sequence ignores the pairing of wefts in the plain weave. (left) weft-float face of the twill; (right) warp-float face of the twill.

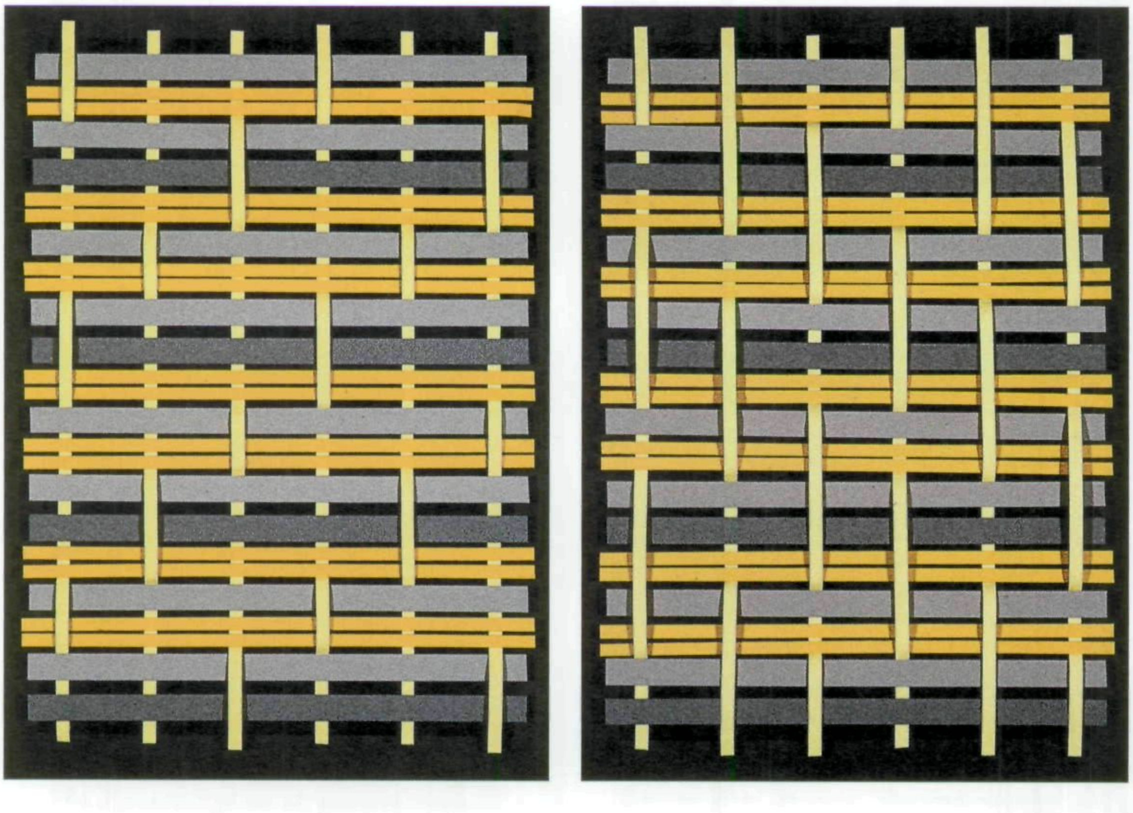


Fig. 8. The interlaced connection of the 1&2 Z-twill—the supplementary weave of the lampas with its paired gold wefts—with only the set of wefts of the plain weave; weft-float face of the twill (left), warp-float face of the twill (right).

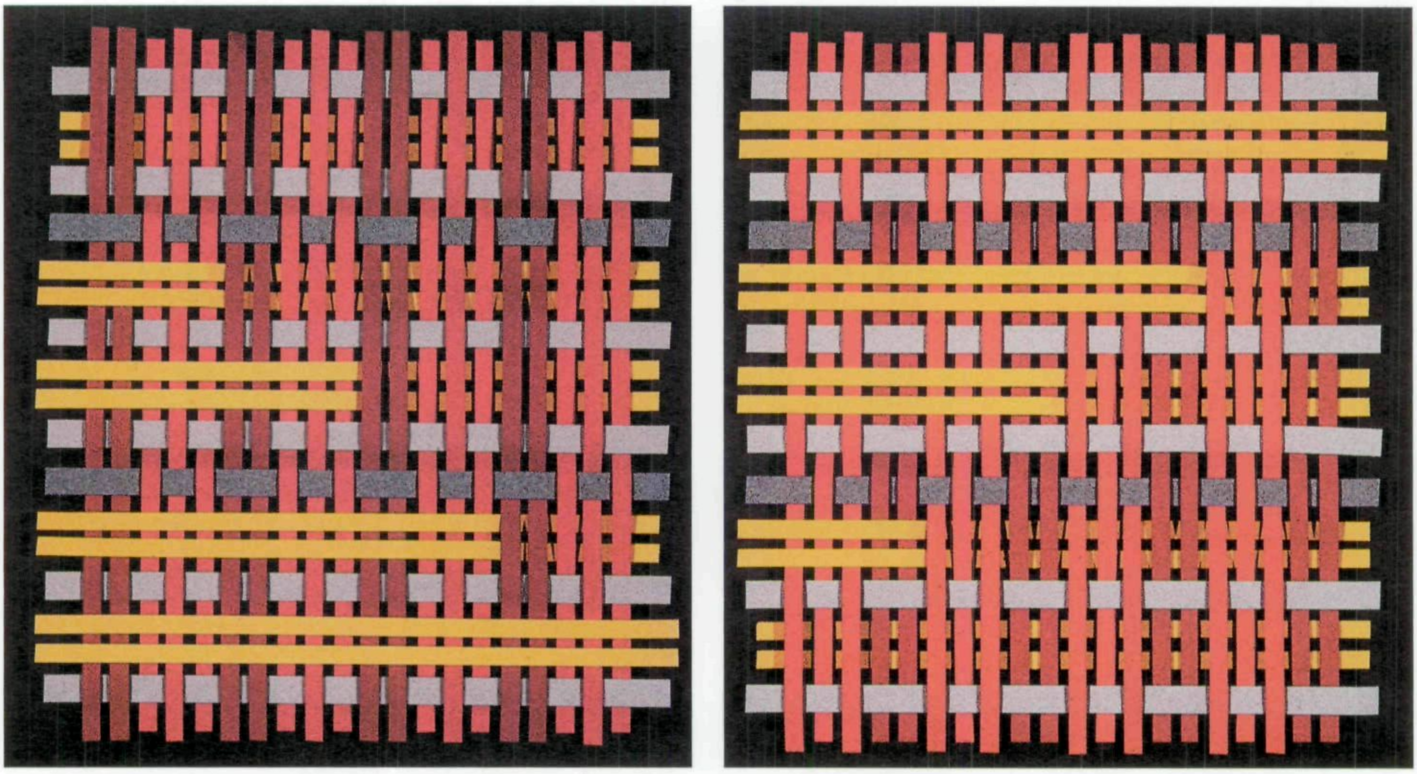


Fig. 9. The lampas technique without the set of warps of the supplementary twill weave. This shows how units consisting of a pair of pile warps and three non-pile warps control the position of gold wefts to the front (left) or to the back (right).

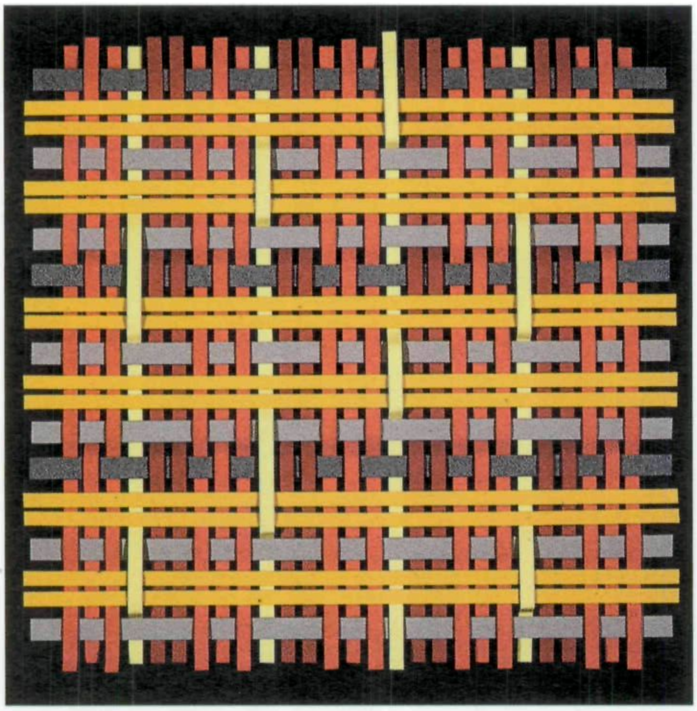


Fig. 10a
Structural detail of lampas/velvet showing area of a gold disk as seen on the front with the weft-float face of the twill. The warp order from left to right shows three non-pile warps, one warp of the supplementary twill, a pair of pile warps, etc. See also, figure 12.

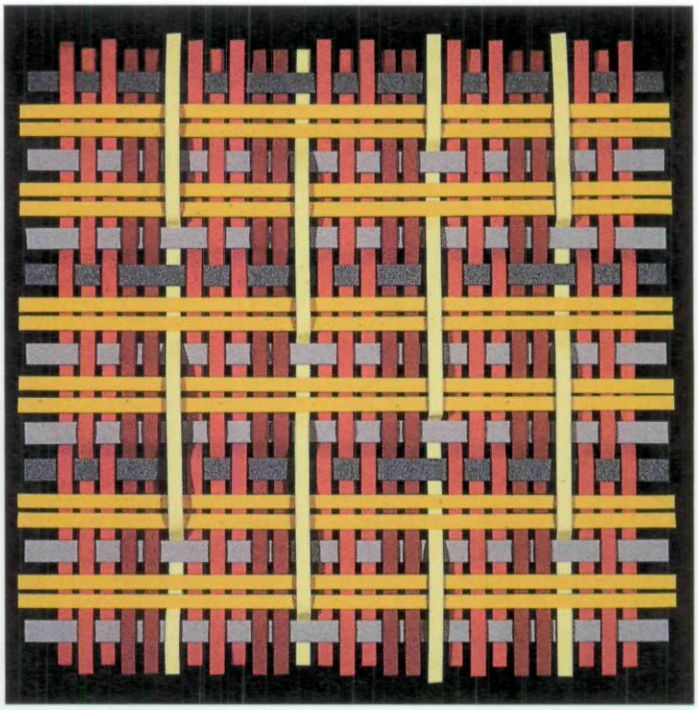


Fig. 10b
Structural detail of lampas/velvet showing area between gold disks as seen on the back with the warp-float face of the twill. The warp order from left to right shows three non-pile warps, a pair of pile warps, one warp of the twill, etc. See also, figure 13.

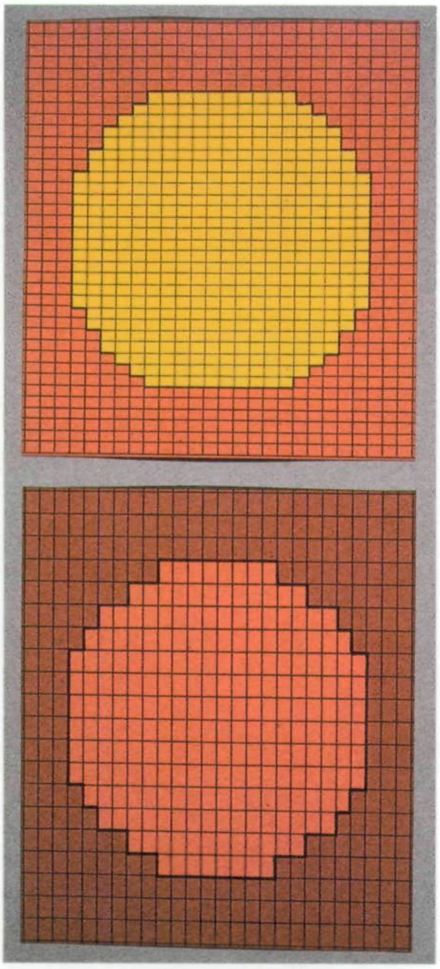
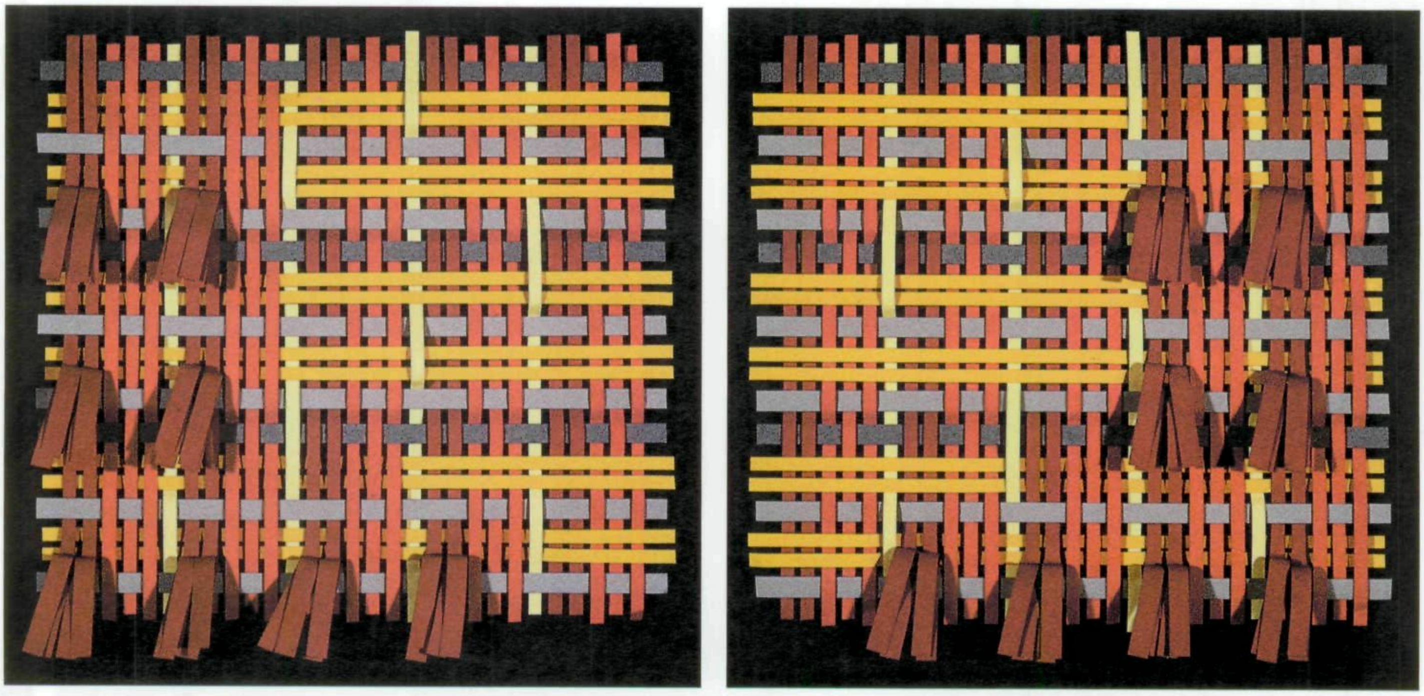
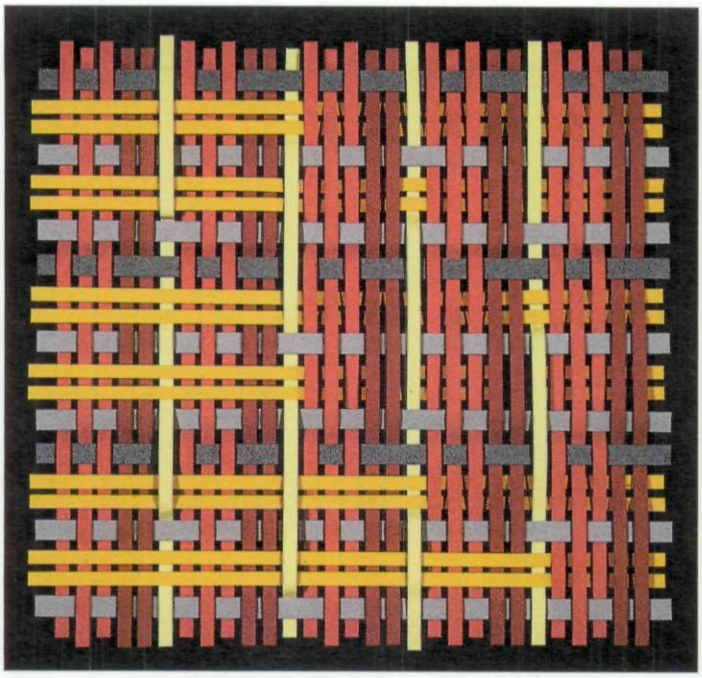


Fig. 11. Contour of the two components of one of the disks shown in figures 1 and 2: (top) the gold disk that fills the void; (bottom) the area voided of pile.

Fig. 12. Full structural detail of the front of the lampas/velvet: (left) at the left edge, gold wefts dip to the back of the cloth next to the three non-pile warps thereby leaving a gap; (right) at the right edge, gold wefts dip to the back next to a pair of pile warps, where overlapping pile obscures this edge of the gold disk.





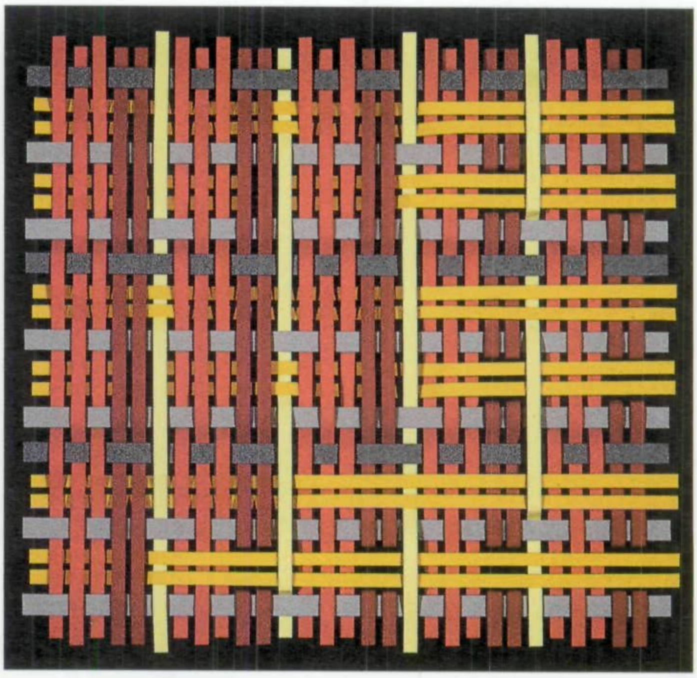


Fig. 13. Full structural detail of the back of the lampas/velvet: (left) the reverse of figure 12, right; (right) the reverse of figure 12, left.

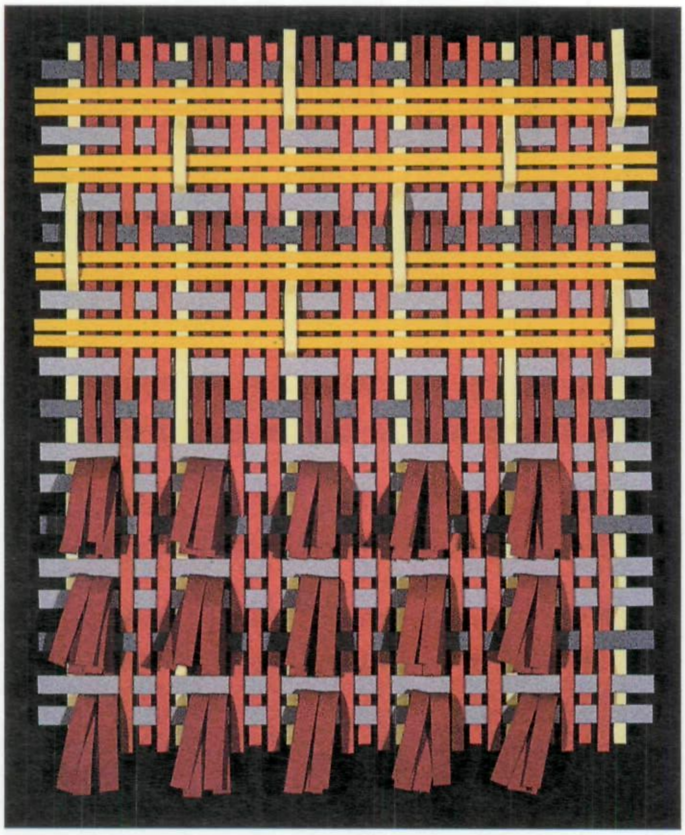


Fig. 16. Full structural detail of the front showing the bottom edge of a disk in which a voided row of pile warps precedes the first gold weft of the disk, thereby creating a narrow gap between pile and gold.

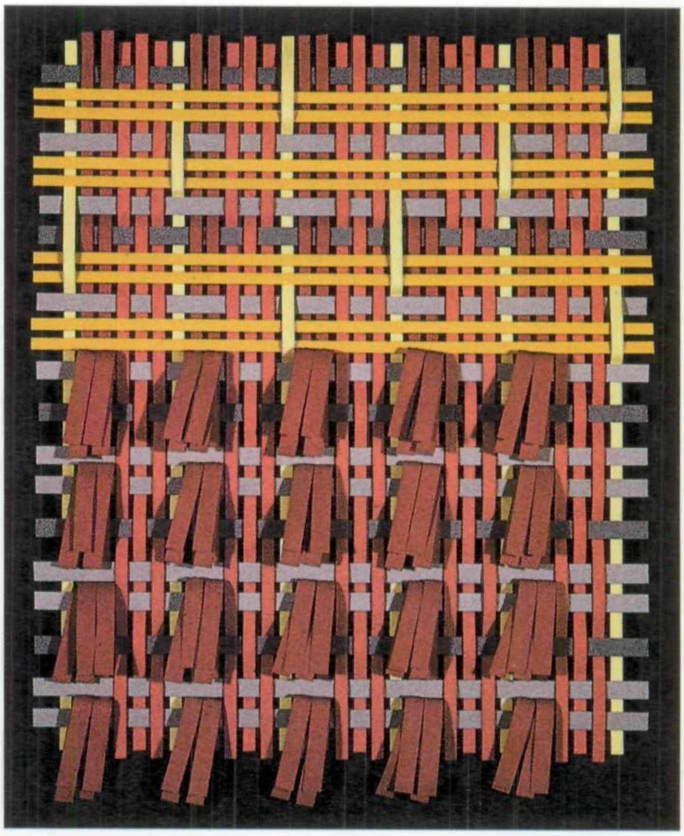


Fig. 18. Full structural detail of the front showing the bottom edge of a disk in which a non-voided row of pile precedes the first gold weft of the disk, thereby eliminating the gap shown in figures 16 and 17.

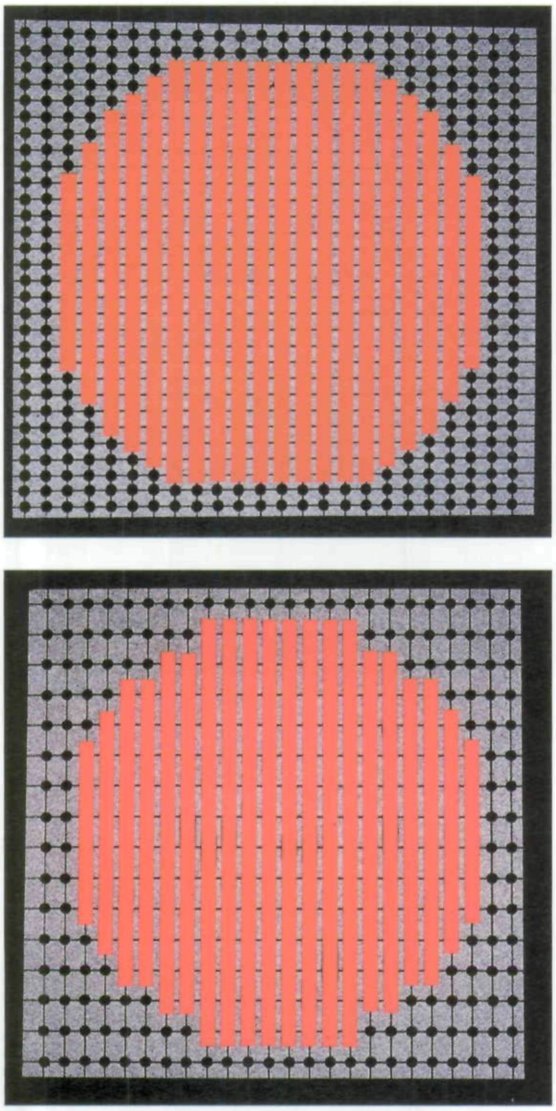


Fig. 21. Diagram of the contour of the two component parts of a "basic" disk in figures 1 and 2, as analyzed from the back: (top) the gold disk; black dots indicate which pair of pile warps and groups of non-pile warps were raised to position pairs of gold wefts to the back. The gold wefts that would be on the back are not shown; (bottom) the void; black dots indicate which pile loops were pulled up on the front.

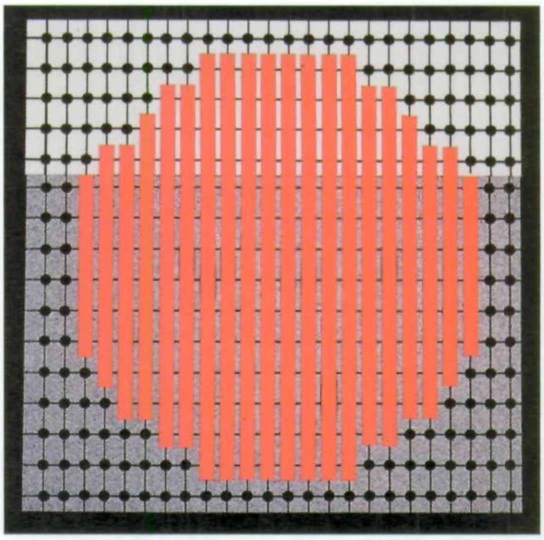


Fig. 22. Diagram of a variation in the contour of the void of the "basic" disk shown in figure 21.

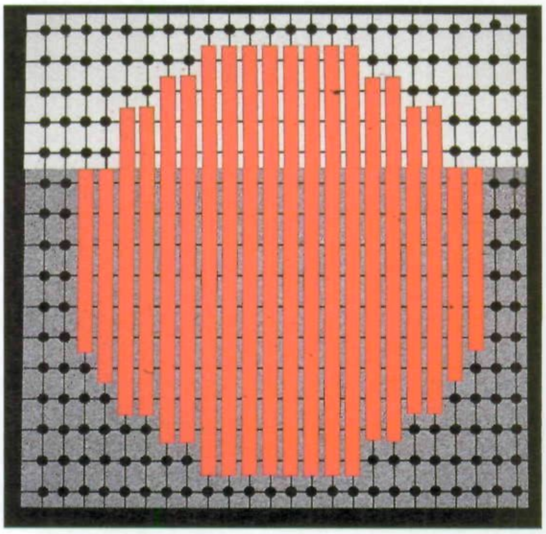


Fig. 23. Diagram of another variation in the contour of the void of the "basic" disk shown in figure 21.

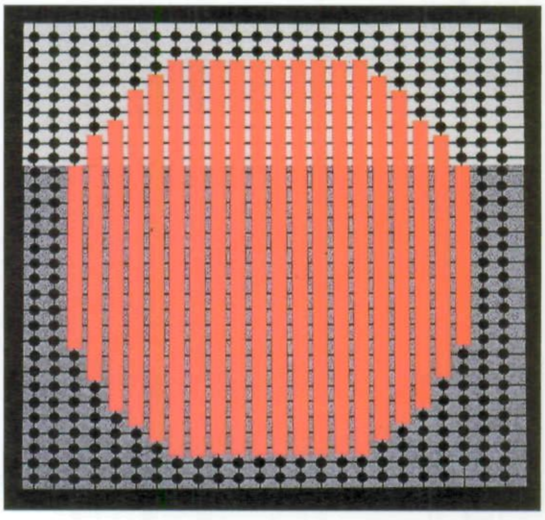
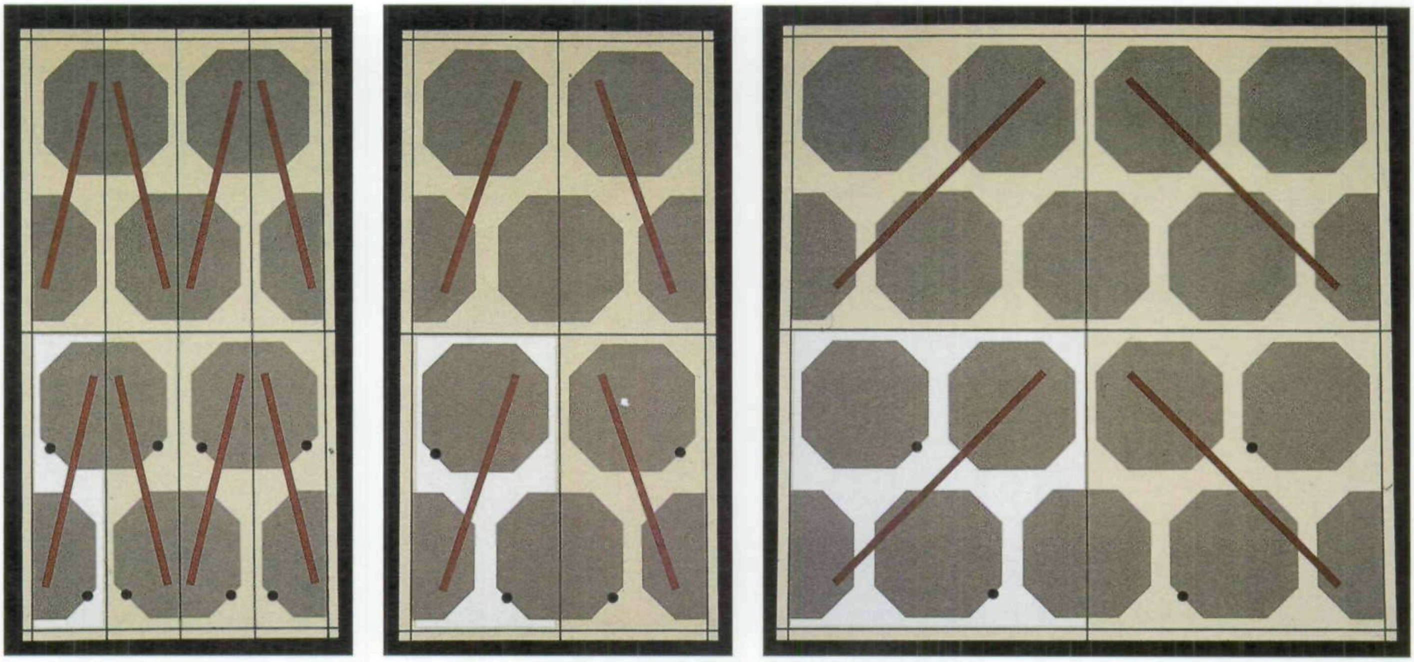
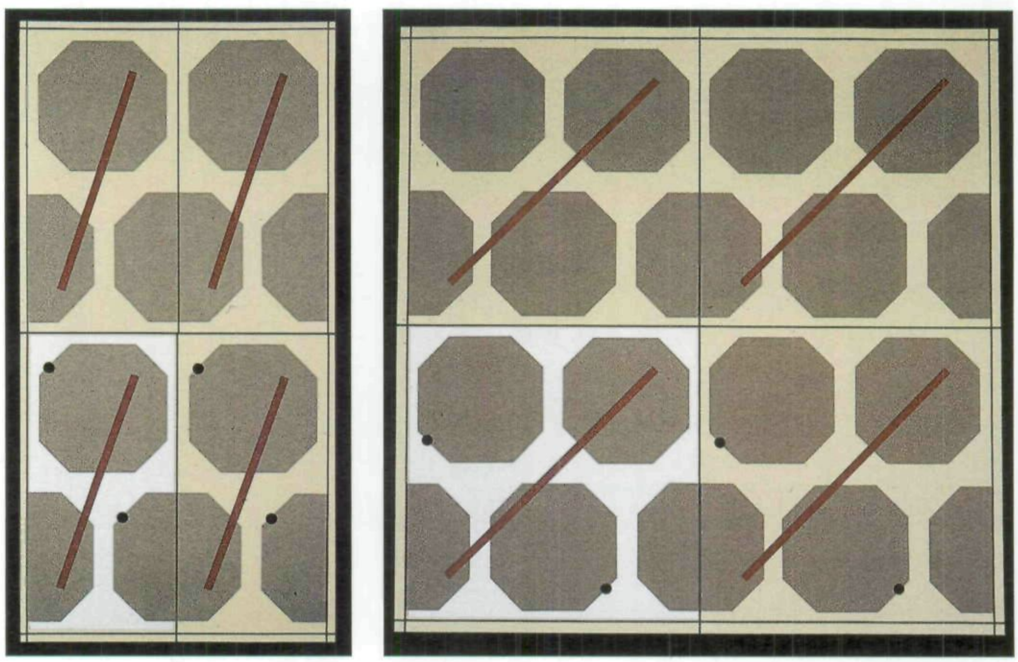


Fig. 24. Diagram of a variation in the contour of the gold disk of the "basic" disk shown in figure 21.



a b c

Fig. 25. Diagrams showing how disks in offset rows could have been repeated: (a) repeat unit with half of a disk from each row mirror-imaged on vertical axes; (b) repeat unit with a full disk from each row mirror-imaged on vertical axes; (c) repeat unit with two full disks from each row mirror-imaged on vertical axes; (d) repeat unit with one full disk from each row set with others side-by-side and others end-to-end, or in a straight repeat; (e) repeat unit with two full disks from each row in a straight repeat.



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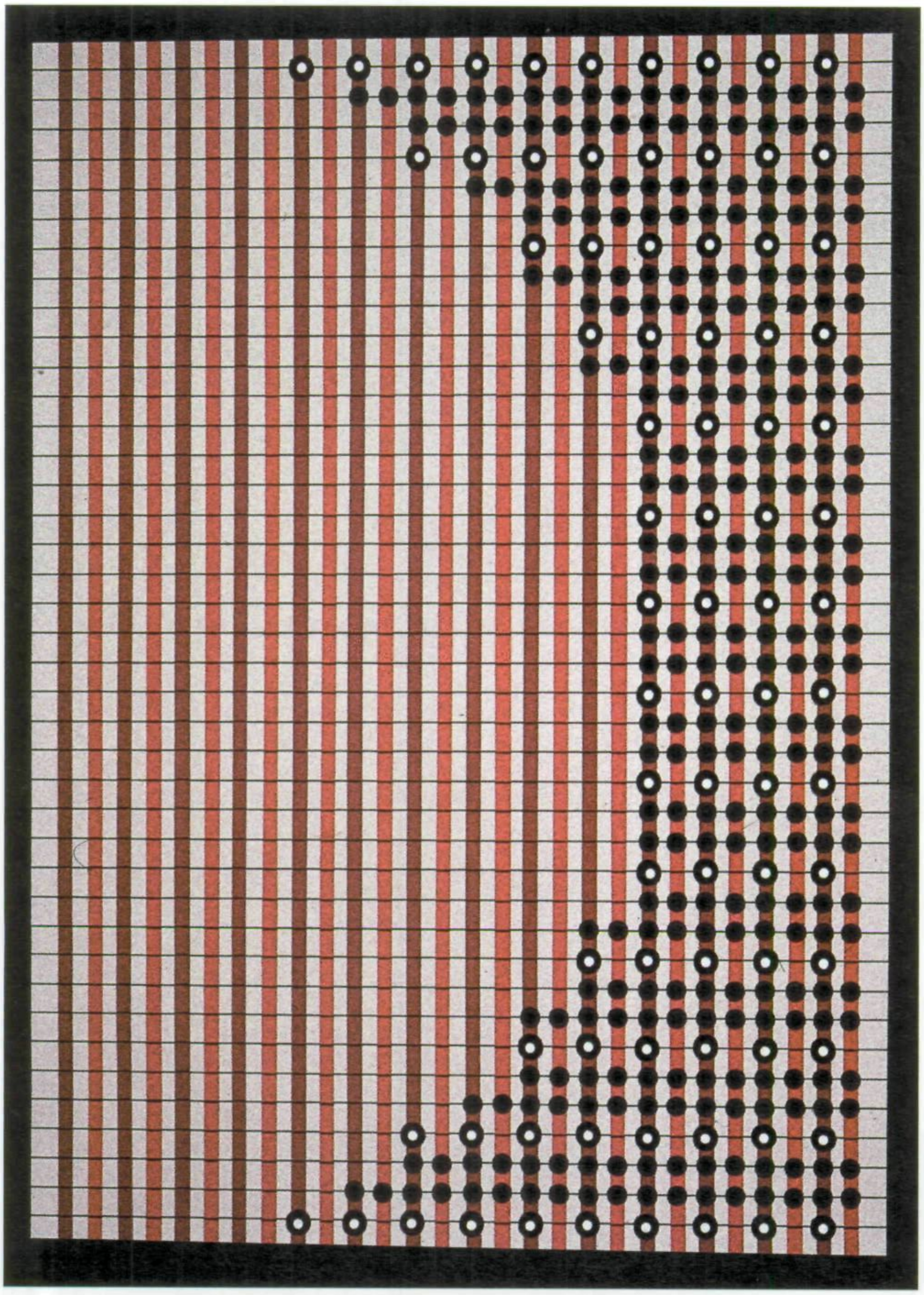


Fig. 27. Half unit of the "basic" disk, the component parts of which are shown in figure 21. Pile warps alternate with groups of three non-pile warps. Weft order: one pile rod followed by two sheds for gold wefts. Dots with white centers represent lifts of pile warps. Smaller dots represent the lifts of pile and non-pile warps needed to position pairs of gold wefts to front or back.

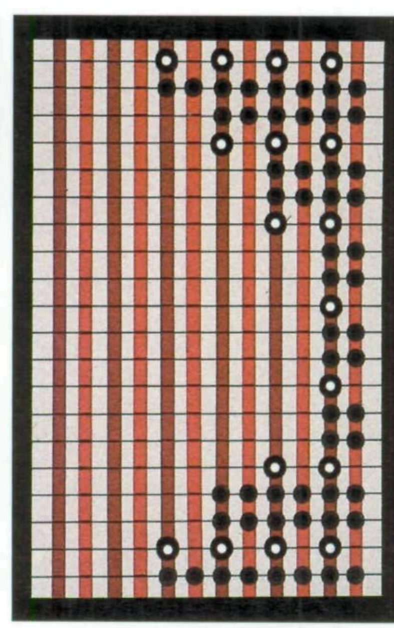


Fig. 28. Half unit of a hypothetical disk that will be used for diagrams in figures 29 and 33.

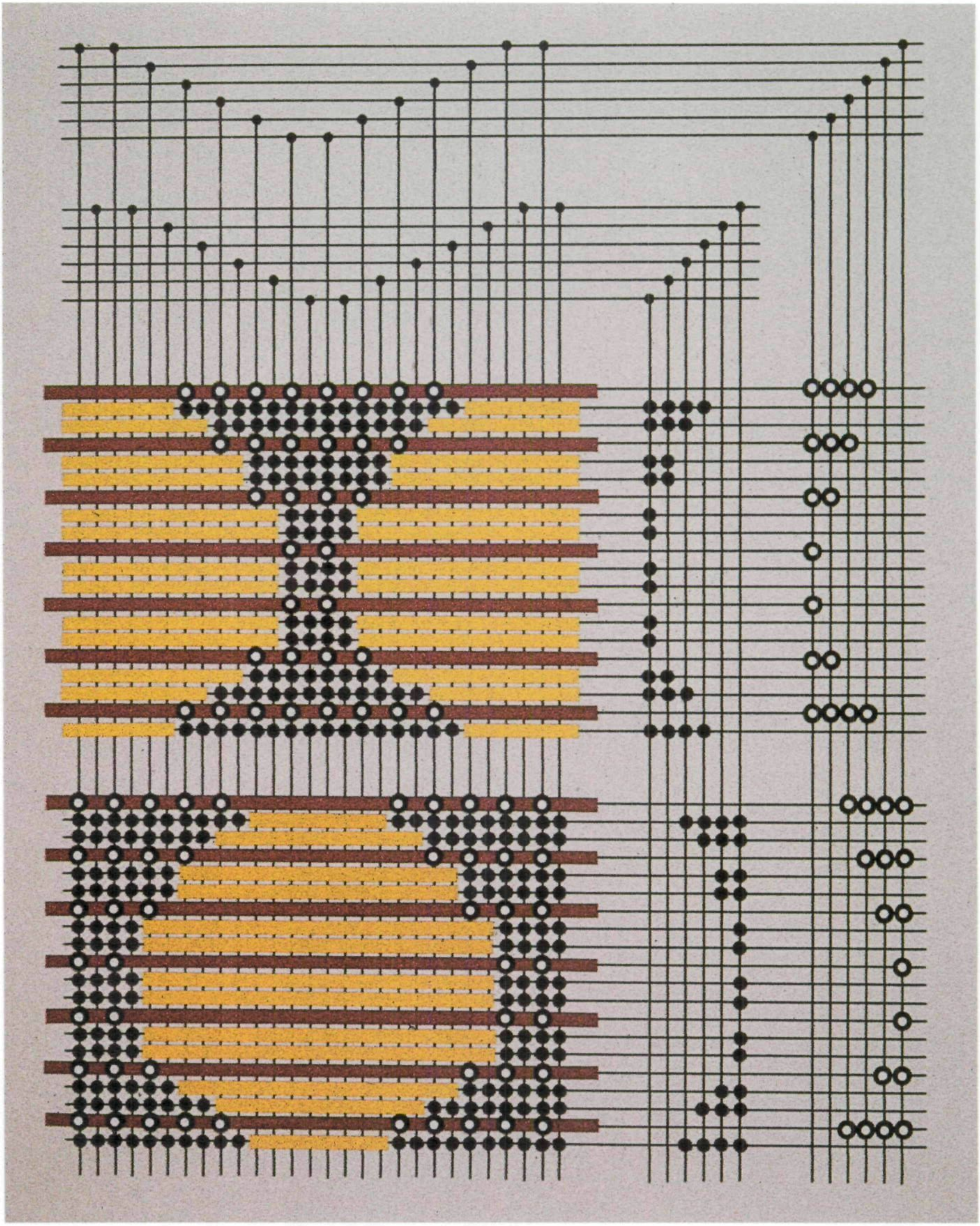


Fig. 29. A plan or draft for a theoretical set-up of a loom's pattern harness.

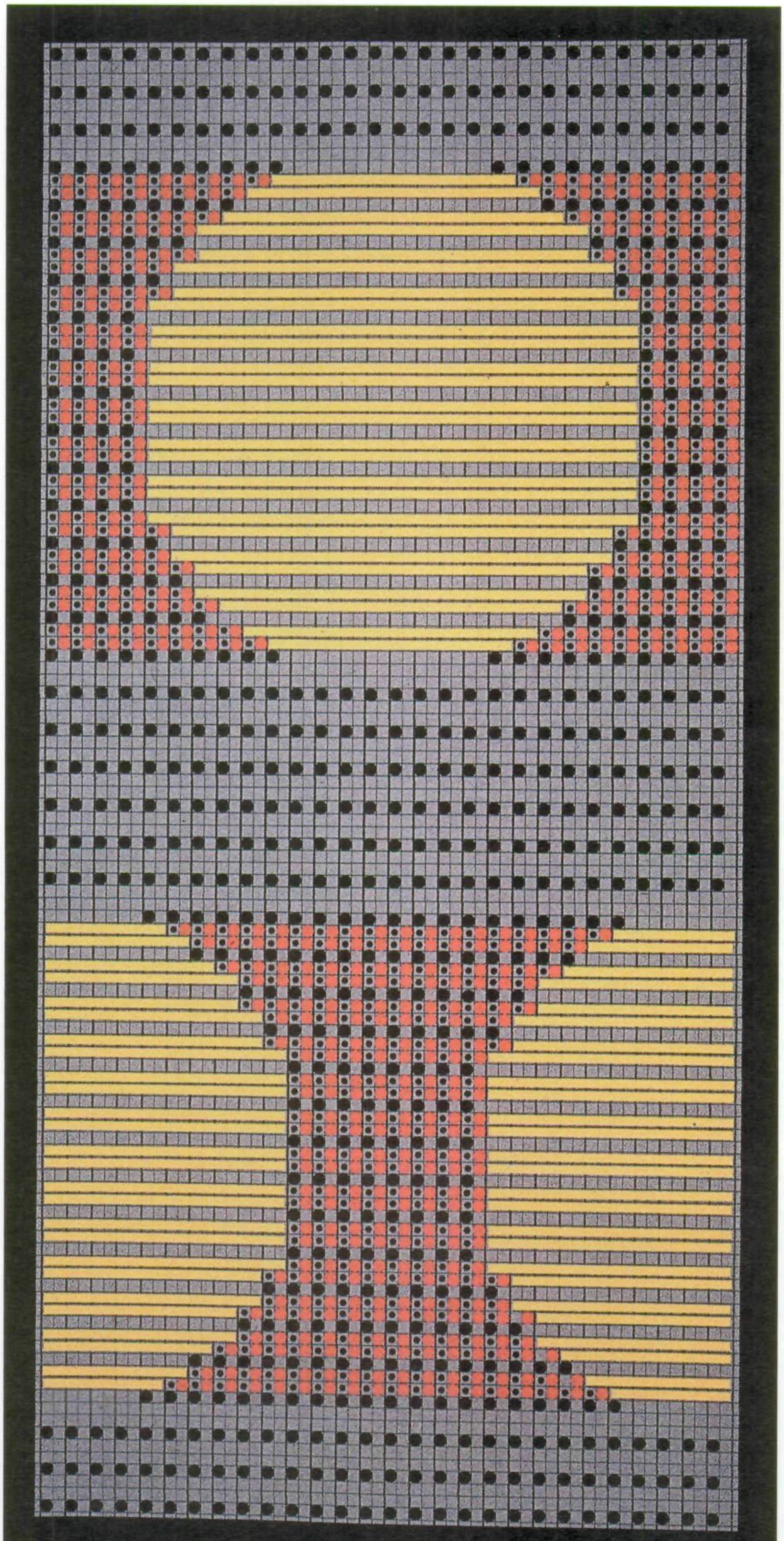
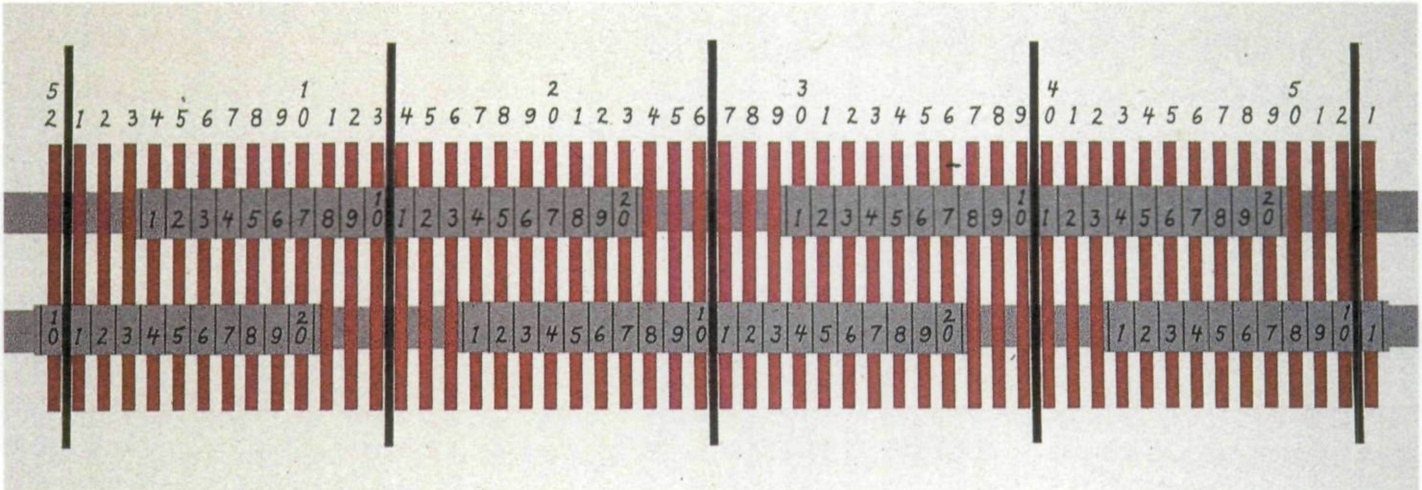
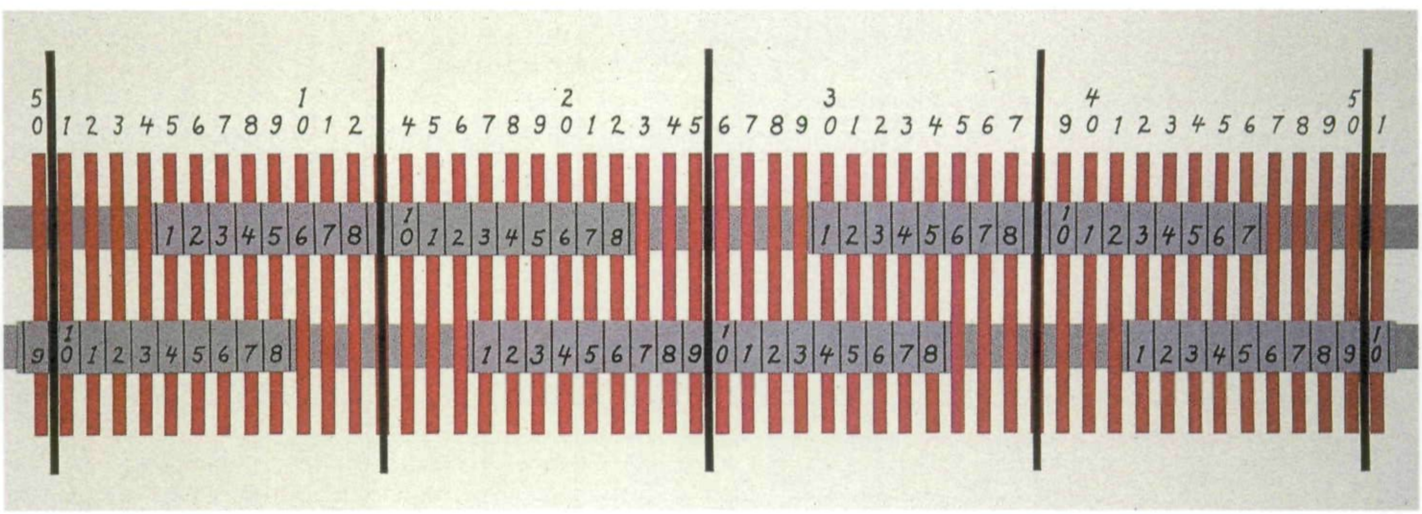


Fig. 30. Diagram of two offset "basic" disks. The repeat unit shown in figure 27 was mirror-imaged on axes that fall between warp pattern steps, or on double-pointed axes as demonstrated in figure 29.



a



b

Fig. 31. Diagrams showing how disks were centered in the two straight repeats (see Table II).

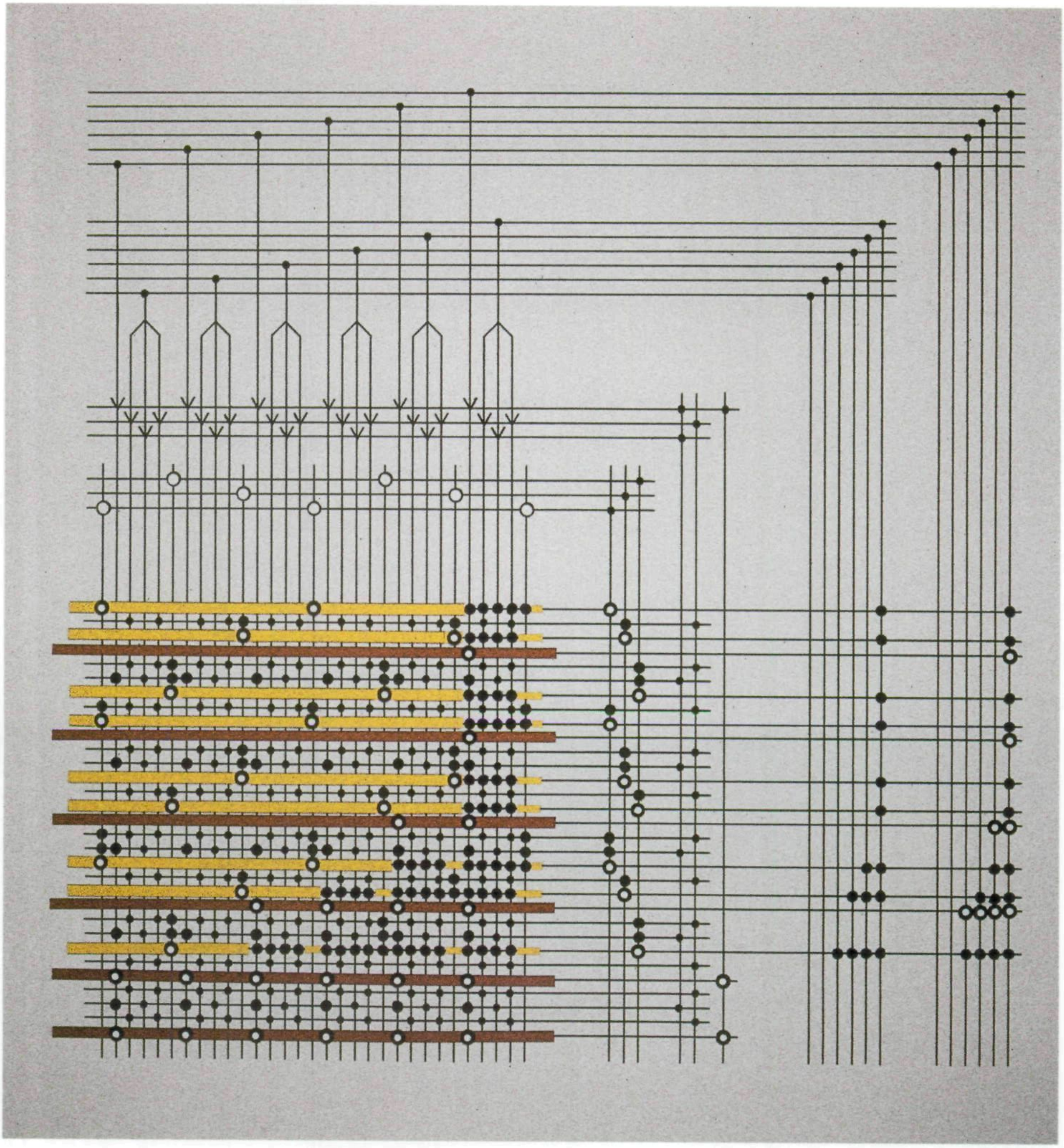
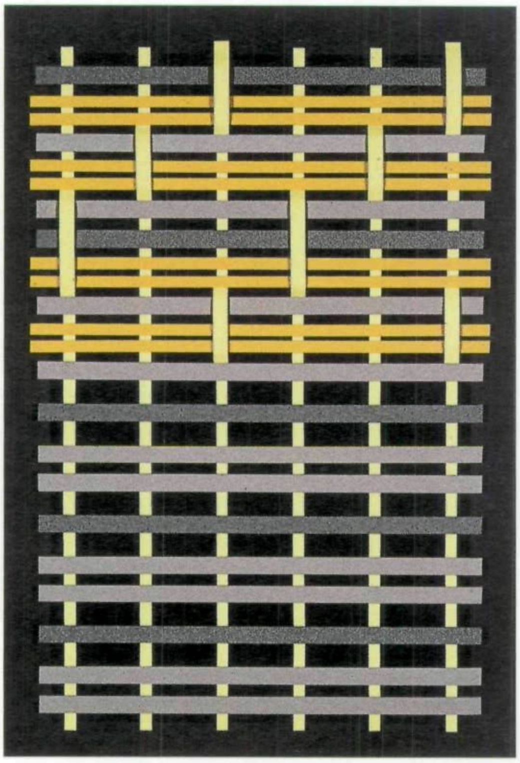
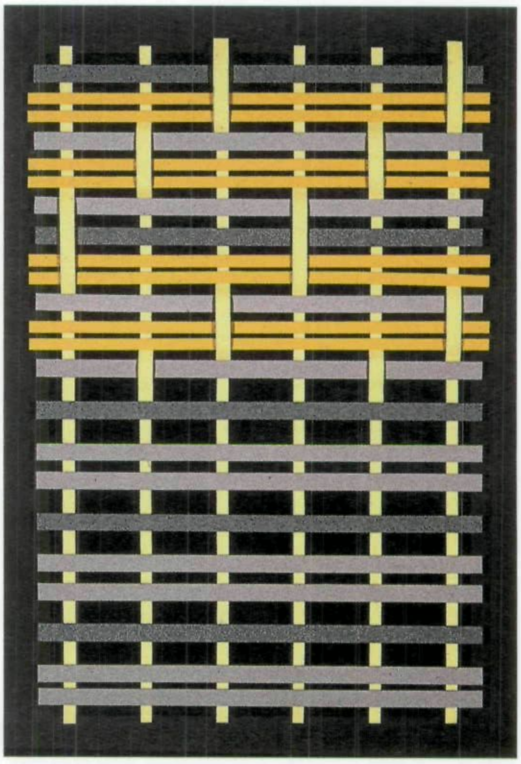


Fig. 33. Theoretical plan or draft for weaving the lampas/velvet (see figure 29 for the pattern harness with its two sets of six cross cords or shafts at the top). Below the pattern harness, the structure harness has three shafts for the plain weave and three shafts for the twill, each with an appropriate number of treadles. Three shafts for the plain-weave foundation are threaded with a set of warps that includes those that are pile warps and those that are non-pile warps in reverse order that makes it possible for only the pile warps to be lifted by means of one treadle. The other two treadles are used for the plain weave that requires all pile and non-pile warps to be lifted (see n. 14). The three shafts for the twill are threaded with the set of warps of the twill in continuous order.

a



b



c

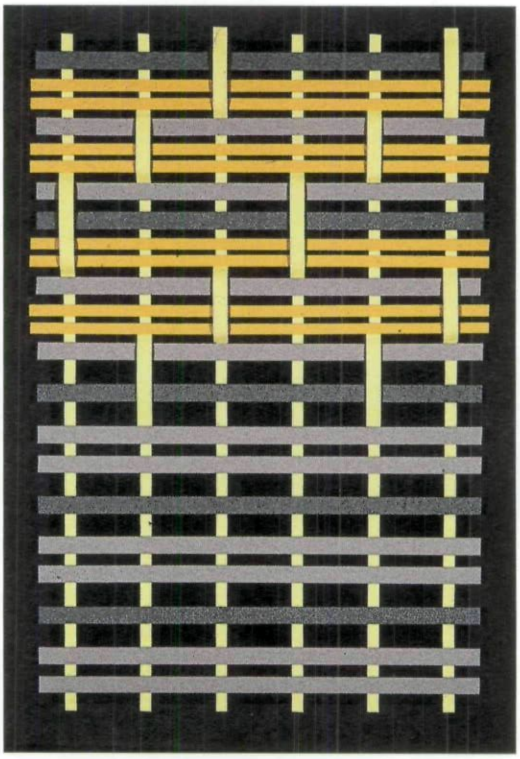
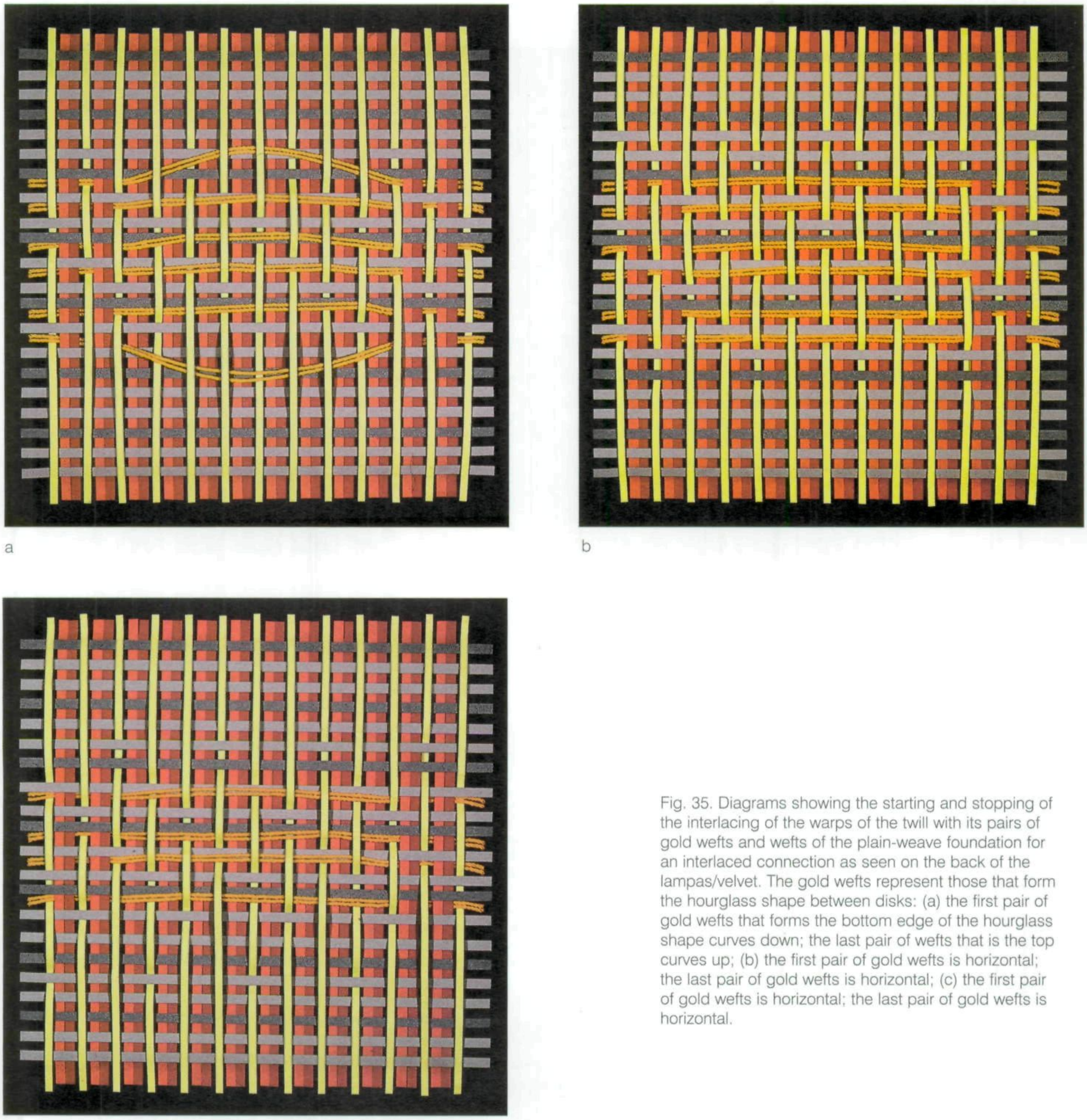


Fig. 34. Diagrams showing three options available to the weaver to start and stop the interlacing of the warps of the twill with its pairs of gold wefts and with wefts of the plain-weave foundation for an interlaced connection. Differences may be noted where the twill warps start to interlace with the first pair of gold wefts. When twill warps are not interlacing with foundation wefts, they float free on the back of the lampas/velvet in the bands between rows of disks, as in figures 20 and 36a-c: (a) interlacing starts with the first pair of gold wefts; (b) interlacing starts with one foundation weft before the first pair of gold wefts; (c) interlacing starts with two foundation wefts before the first pair of gold wefts.



a

b

c

Fig. 35. Diagrams showing the starting and stopping of the interlacing of the warps of the twill with its pairs of gold wefts and wefts of the plain-weave foundation for an interlaced connection as seen on the back of the lampas/velvet. The gold wefts represent those that form the hourglass shape between disks: (a) the first pair of gold wefts that forms the bottom edge of the hourglass shape curves down; the last pair of wefts that is the top curves up; (b) the first pair of gold wefts is horizontal; the last pair of gold wefts is horizontal; (c) the first pair of gold wefts is horizontal; the last pair of gold wefts is horizontal.

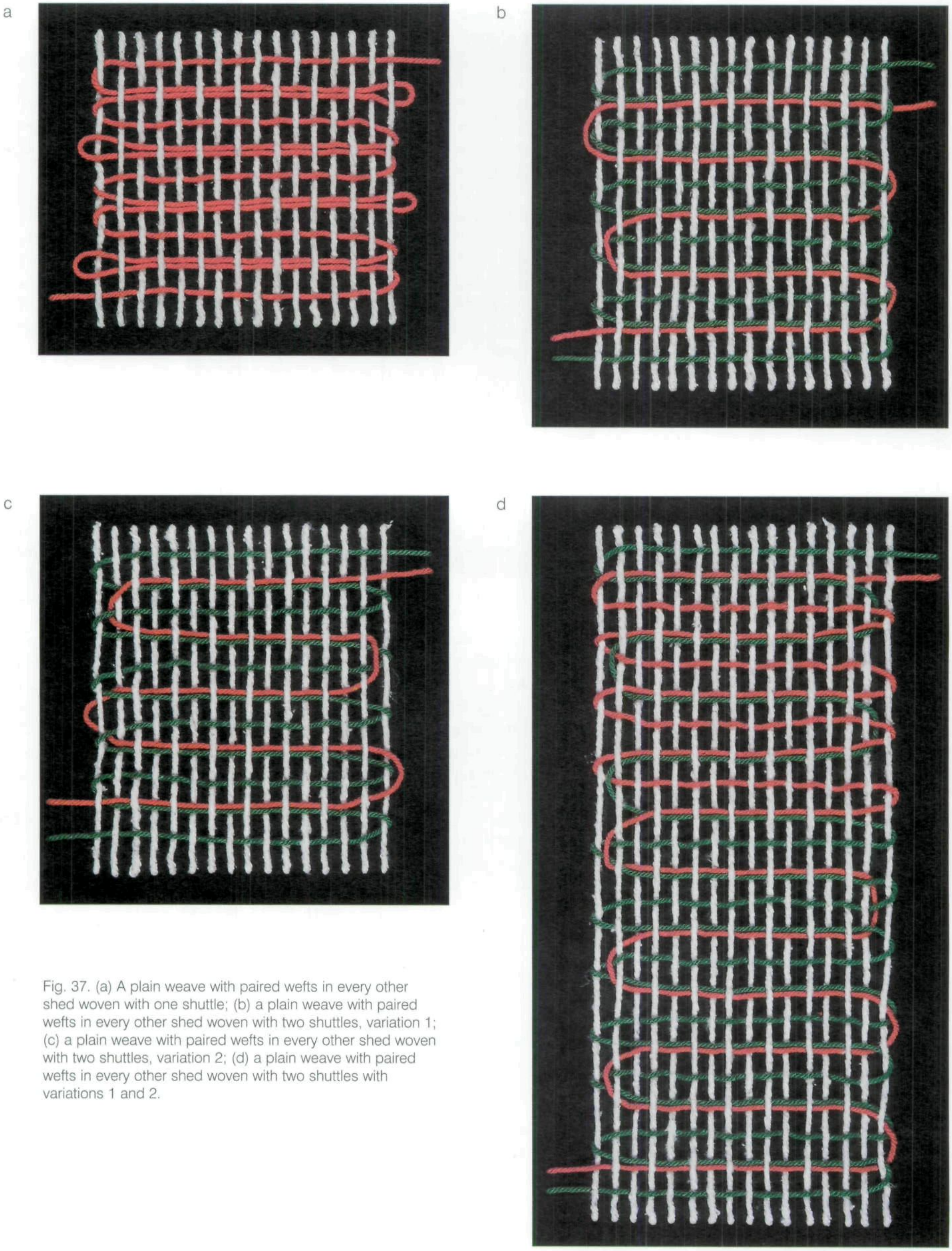


Fig. 37. (a) A plain weave with paired wefts in every other shed woven with one shuttle; (b) a plain weave with paired wefts in every other shed woven with two shuttles, variation 1; (c) a plain weave with paired wefts in every other shed woven with two shuttles, variation 2; (d) a plain weave with paired wefts in every other shed woven with two shuttles with variations 1 and 2.

The pattern, when looked at closely (fig. 2), is composed of disks, more octagonal than circular. Small hourglass-like shapes remain as negative space between disks, and narrow horizontal bands separate rows of disks. The fronts and backs of these three areas will be looked at in detail in order to understand the unique features of the fabric. Disks are offset approximately on a 60-degree diagonal.

Shared features include the following: cut pile slants down and slightly to the left, gold wefts are bound on the front in a 1&2 twill, and gold wefts are paired in each shed of the twill. The gold wefts of these pieces are composed of narrow strips of "gilded" animal material (parchment, membrane, or leather) wound in the Z-direction around a yellow (possibly also pale rose, tan, or orange) silk core that has a Z-twist (Indictor 1988, Table 2, p. 9). The narrow strips of animal material almost completely cover the silk core. It is generally assumed that gilded animal material was not used for woven silks after the fifteenth century; this provides a terminal date for the weaving of the velvets in this group.

Three features can easily be seen on the backs of the textiles (figs. 2, 36a-c). First, gold wefts are used only as needed in bands for the rows of disks. Second, gold covers the hourglass-shaped spaces between disks in each row. Third, a set of beige (yellow?) silk warps float on the back between rows of disks.

Other shared features require closer observation. The warps for pile are a cool red silk and are used in pairs. The non-pile warps are a warmer red silk. All warps have a firm Z-twist and are similar in diameter, although irregular. The sequence of these warps (the warp order) is one pair of cool red pile warps (one pile warp pair) to three warm red single warps (non-pile). The dye for the cool red has been determined to be that of the insect cochineal, and for the warm red, the madder plant.[7]

It should be noted that the color of the pile warps of the example in the Museum für Angewandte Kunst in Vienna is blue-green. Difference in color by itself does not indicate a different loom. A set of warps of another color can be tied onto a set already on a loom. Similarly, a weft can easily be changed simply by using a thread of another color.

The study that follows is divided into two sections. The first discusses features that can be determined by looking at the fabric, including structure, warp order, weft order, details of the two basic patterning techniques, the contour of disks and their layout, and clues that might help to determine a repeat system. The second section covers more theoretical features, including a consideration of loom types that satisfy the requirements set by specific interlacing orders, a discussion of repeat systems, and a proposal for how a loom might have been warped and set up to weave these structures and pattern.

Studies of structure and technique alone will not allow us to determine the origin of a single cloth or a closely related group of cloths. Therefore, I conclude with a discussion in which I summarize aspects of Anne Wardwell's work in order to bring this group of velvets patterned with offset rows of gold disks into clearer perspective.

Surfaces and Their Structure and Basic Techniques

I begin by taking the velvet apart—warp by warp, and weft by weft—and continue by putting everything back together in the form of weaving plans, so as to consider the cloth as a whole.

As stated above and as seen in figure 2, the front of these fabrics has two surfaces, cut pile, and gold wefts bound in 1&2 twill order. The back has three surfaces determined by characteristics of the twill. First, the backs of gold disks have no gold wefts. Second, gold wefts bound in 2&1 twill form the hourglass-shaped spaces between disks. Third, the narrow bands between rows of disks are not covered by gold wefts and are "veiled" by free-floating warps of the twill, most of which are worn off in each of the examples studied.

The first aspect to be discussed is the nature of the pile. The warps that form pile are derived from plain weave (fig. 5). The over-one/under-one sequence of plain weave is achieved by all warps: the pairs of warps that make pile working together as one structural unit and the three single non-pile warps, each a structural unit. On the front of the fabric, selected pairs of warps for pile are pulled up as a loop between a pair of wefts in one shed of the plain weave, which I will term shed "a". These pairs of wefts act as a vise that helps secure the pile in the plain weave. As a result of pulling a pile warp pair up as a loop between the pair of vise-wefts, the non-pile warps immediately to left and right of the pile warp also act as a vise by passing over the pair of wefts that form the vise of shed "a". In accordance with plain weave, appropriate pile and non-pile warps go over the single weft of shed

"b", schematically shown as a darker weft in figure 5.

The plain-weave interlacing sequence and tiny holes—the points at which pile warps were pulled up on the front as loops—are clearly visible on the back, thus making it easy to count warps and wefts. The spacing of warps and wefts in all the diagrams in this study is based on the count of pile of Cooper-Hewitt 1902–1–385, which is 14 to 15 (across the warp) by 10 (along the warp), or about 145 per square cm.

The weft order, or the sequence of making sheds for weaving only the velvet, is shown in figure 5. Reading up, or in the direction of weaving, the sequence is: the first of the pair of foundation wefts in shed "a", the rod or gauge over which pile warps were looped, the second of the pair of foundation wefts in shed "a", and then the weft in shed "b", etc.

Interpreting the basic structure of the velvet as a plain weave, in which every fourth warp of one set of warps is pulled up as a loop, runs counter to the interpretation that pile warps are a supplementary set of warps, or a set of warps added to a foundation with its own set. This in itself I find intriguing.[8]

Techniques for making and cutting pile loops to produce an allover surface texture or pattern are fairly straightforward. Three pairs of pile warps are shown in figure 5. All were lifted for shed "b" of the plain weave. When needed for pile, they were also lifted individually between the vise-wefts of shed "a". Areas with no pile, in other words, areas that were "voided," were filled with gold wefts. Obviously then, the take-up, or rate at which individual pile warps were used, differed from one to the other and, collectively, was much greater than the take-up of non-pile warps. Therefore, we can imagine a loom with a warp beam holding the non-pile warps under appropriate tension and another device for holding pile warps under considerably less tension.

A second patterning technique was used for the gold wefts forming the disks that fill the areas voided of pile—a technique that requires a step-by-step explanation. Following more recent usage, it is called *lampas*. I define lampas, a centuries-old technique, as a combination of two weaves, a foundation weave and a supplementary weave that is attached to it. From my point of view, to qualify as a lampas, each of the two weaves must be able to stand on its own if theoretically separated. The foundation is probably always dominated by its set of warps, and the supplementary weave is probably always dominated by its set of wefts. In the case of this lampas, the foundation is the plain weave/velvet and the supplementary weave is the 1&2 twill with pairs of gold wefts.

The warps that float on the back of the velvet (figs. 2, 36a–c) are those of the set that bind the gold wefts of the supplementary weave in twill order. The interlacing of these warps with pairs of gold wefts can be considered its own fabric which is a 3-unit twill: on the front face a 1&2 Z-twill and on the back face a 2&1 S-twill (fig. 6). They are also the warps that attach the twill to the velvet (fig. 7).

The direction of the supplementary twill may vary from piece to piece. The direction is S in Brussels TX 465 and the six pieces studied in The Textile Gallery, London. Of the five pieces that make up Bargello F127, the direction of one small and one medium-sized piece is Z. But the twill direction is S for one tiny bit, another small piece, and the length. According to a brief description provided by the Musée des Tissus, the direction of the twill in the chasuble in Lyon is S, but it is not known how many pieces make up the chasuble. Three features determine a twill's direction: the diagonal sequence of the threading, the tie-up, and the order in which treadles are used. Without a loom it is impossible to determine which of these governed the supplementary twill's direction. A single workshop or workshops within a specific area may or may not have unvaryingly used the same twill direction.

Having established the integrity of the two weaves, each with its own sets of warps and wefts—the plain-weave foundation with pile warps and the supplementary 1&2 twill with gold wefts—it is the precise way in which the attachment is achieved that further qualifies the type of lampas. The attachment is achieved by means of the warps of the supplementary weave interlacing with the wefts of the foundation weave, or not, as the case may be. This lampas has an interlaced connection of the two weaves.[9]

The twill fabric is attached to the plain-weave/velvet foundation in an interlacing order as illustrated in figure 7, which has only wefts of the foundation and only warps of the twill. Figure 7 demonstrates that the interlaced connection of the lampas/velvet foundation and the twill has nothing to do with the pairings of foundation wefts that act as vises for pile.

Figure 8 is essentially the same as figure 7, but the gold wefts of the 3-unit twill are added to illustrate the order of the set of wefts of the plain

weave and the set of wefts of the twill. Starting at the bottom, in the direction of weaving, the weft order is: two foundation wefts, the first paired gold wefts of the twill, one foundation, the next paired gold wefts of the twill, etc. It is best not to dwell here on the precise interlacing sequence of the twill warps with its gold wefts and the wefts of the foundation, discussed below.

The pairs of gold wefts of the twill are positioned either to the front or to the back by all the warps of the foundation, which, in this case, include the pairs of pile warps and the groups of three non-pile warps. This is demonstrated in figure 9 by a diagram in which the set of warps of the twill is omitted.

Figure 10 introduces the first diagrams of the full structure of the lampas/velvet to show warp order and how pairs of gold wefts appear on front and back. The diagram on the left (fig. 10a) presents an area of a gold disk as seen on the front with the weft-float face of the twill. The warp order from left to right shows three non-pile warps, one warp of the supplementary twill, a pair of pile warps, etc. A warp of the twill is to the left of a pair of pile warps. Chris Verhecken-Lammens notes that the warp order in Brussels TX 465 positions a warp of the twill to the right of a pair of pile warps. While this is a minor point, it does indicate another warp set-up and a different length of cloth. I did not find the Brussels variation of the warp order in other pieces I was able to double-check. The diagram on the right (fig. 10b) presents an area between gold disks as seen on the back with the warp-float face of the twill. Here, the warp order from left to right is three non-pile warps, a pair of pile warps, one warp of the twill, etc.

A Basic Disk

Patterns of all woven fabrics must conform to the squared relationship of warps and wefts and are, therefore, composed upon and conform to a squared grid. This explains why woven patterns, when looked at closely, have stepped edges. A pattern grid is made up of individual units; its width is determined by the nature of the warp pattern step, and its height is determined by the nature of the weft pattern step. Figure 11 shows the two components of a disk of figures 1 and 2: at the bottom is the void in the velvet; at the top are the gold wefts of the disk that fill the void. The width of each warp pattern step is governed by factors having to do with warps that pattern or control a weft or wefts that pattern. Significant factors include their diameter and number of warps or wefts per unit of measure. In the case of this velvet, it is the pairs of pile warps that pattern by having been lifted to form loops. For example, figure 5 shows three pairs of pile warps individually controlled for pattern, and in figures 12 and 13 there are five. In other words, there is a pair of pile warps in each warp pattern step of the velvet. In the case of this lampas, each warp pattern step has a pair of pile warps and three warps that are lifted to position the pairs of gold wefts of the twill to front or back of the foundation. There are five such warp pattern steps in the four diagrams that make up figures 12 and 13. We have already established that pile warps pattern independently. Therefore, the groups of three non-pile warps are also independently controlled. Both pile and groups of three non-pile warps must be used together for lampas, but they are not always coordinated so the edges of disks meet the edges of the voids that they fill. Such is the case with Brussels TX 464 where there is a gap surrounding gold disks and pile. I noticed this feature in other pieces as well.

The set of warps of the twill is not needed for the pattern and, therefore, is not included in the discussions of patterning techniques.

A pattern grid is completed by weft pattern steps, the height of which is determined by thickness, count per unit of measure, etc., of the wefts that pattern. In this lampas there are two: the rows of rods acting as wefts over which the loops of pile warps were formed, and the pairs of gold wefts of the twill.

The count of warp pattern steps of the two components of the disk shown in figure 11 is the same (15 per cm). The count of the weft pattern steps of the two components is different. That of the velvet is 10 loops or rods per cm, but that of the gold is 20 sheds of the supplementary twill. The count of the gold weft pattern steps is higher because there are two sheds of the twill between each row of pile. Each shed of the twill has a pair of gold wefts. Thus, the stepping off of the pile to form circular voids is much coarser than the stepping off of the gold wefts for the disks that fill the void.

We can now look at close-up views of the edges of disks. The model in figure 12 shows a pile warp pair on the left of the three non-pile warps in each warp pattern step of the lampas; the gold wefts forming the left edge of a disk dip to the back next to the group of three non-pile warps. This is visible on the front of the fabric (fig. 14). At the right edge, gold wefts dip to the

back next to pile warps. This is not easy to see on the front of the fabric because pile warps are slightly slanted to the left, thereby obscuring this edge of the disks. Where gold wefts dip to front and back is much clearer on the back, but left-right positioning of pile and non-pile warps is reversed (fig. 13).

The combining of the weft pattern steps of the velvet and lampas techniques can be expressed in terms of the weft sequence or weft order, part of which may be seen on the back of the fabric (fig. 15). Although two twill sheds or two pairs of gold wefts between rows of pile are visible, it is not clear just where the rods or gauges that form and determine the size of the loop or length of cut pile are inserted in the weft order. The weft order is also not easily seen, but I have determined that it follows the first vise-weft in shed "a" of the plain weave and precedes a pair of gold wefts of the twill (figs. 12, 13). The weft order, perhaps better expressed as the order in which sheds are made, is a repeat of the following weaving sequence from bottom to top; where it begins and ends is arbitrary:

- shed "a" of the plain weave plus a continuation of the previous shed of the twill for insertion of a foundation weft;
- velvet pattern selection and lift for insertion of rod or gauge;
- lampas pattern selection and lift plus next shed of the twill for insertion of a pair of gold wefts;
- repeat of shed "a" of the plain weave plus same shed of the twill;
- lampas pattern selection and lift plus the next shed of the twill for a pair of gold wefts;
- shed "b" of the plain weave for which pile and non-pile warps are lifted plus the same shed of the twill for insertion of a foundation weft;
- repeat of the sequence.

The features that distinguish the left and right sides of a disk are common to all the disks I examined, but the bottom edge varies in two ways. In the first variation (fig. 16) the disk begins with a row of pile that is voided. The result is a narrow gap between the previous full or non-voided row of pile and the first pair of gold wefts of the disk. This can easily be seen on the front (fig. 17). In the second variation (fig. 18) the disk begins with the first pair of gold wefts that are brought to the front to form a disk. These wefts are tightly packed against the previous non-voided row of pile because both the pile and the gold wefts are held between the vise-wefts of shed "a" of the plain weave. Both variations could be woven on the same loom.

All disks I have studied end with a voided row of pile at the top which creates a gap similar to the gap at the bottom. This feature is consistent, no doubt because a close juxtaposition of the last gold weft of the disk would have been covered by the overhanging pile of the subsequent non-voided row (fig. 19). The gap at the top is covered by overhanging pile.

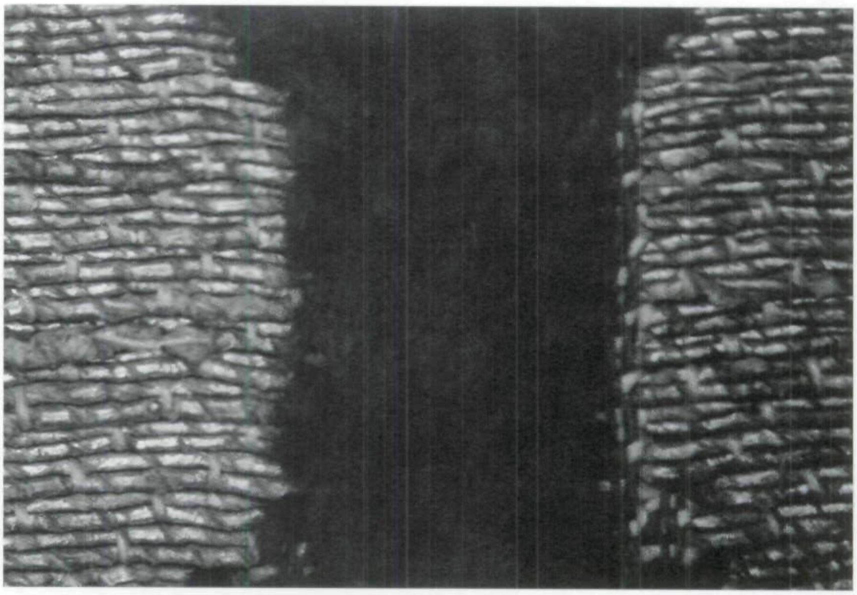


Fig. 14. Detail of the front of a disk in figures 1 and 2, showing the left and right straight edges of the central third of the disk.

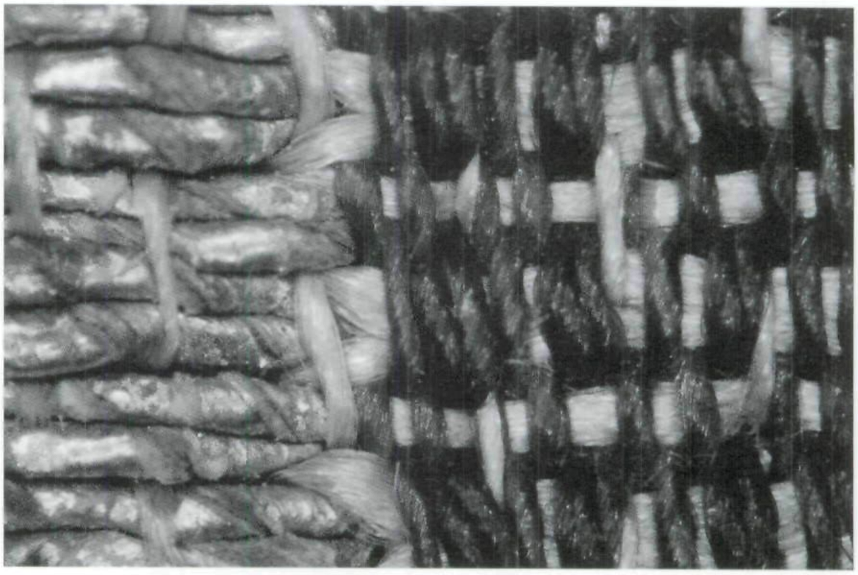


Fig. 15. Detail of the back of the straight edge of the central third of a disk showing weft order, including pairing of gold wefts in each shed of the twill.

Some velvets have a curious feature: short vertical dashes that are not regularly spaced across the width of the fabric. These can be seen in Cooper-Hewitt 1902–1–385 (fig. 1) and Brussels TX 464 (fig. 3, right). I noted them also in the pieces in the Stibbert and in the larger piece in the Bargello, but not across the entire width. Some are vertically aligned and others are not. Exactly what causes the dashes is not always clear. Those that are vertically aligned appear to have been caused by a pairing of non-pile warps of more than three non-pile warps in the warp order. Those that are not vertically aligned might have been caused by a slight difference in tension among the three non-pile warps that are between pairs of pile warps. A slightly higher tension on the warp in the middle (the warp that is raised for shed "b") might have caused the two warps to the left and right (the warps raised for shed "a") to separate, thereby creating a gap between pile warps.

Fig. 19. Detail of the top edge of a disk showing how pile, slanted down, slightly obscures the last pair of gold wefts of the disk.

Fig. 17. Detail of the bottom edge of a disk showing the gap between a voided row of pile and the first pair of gold wefts of the disk as demonstrated in figure 16.

Disk Variations

Regardless of the details of their edges, all disks are octagonal (fig. 20) and can be divided into three sections: a bottom third with a horizontal base and slanted sides, a middle third with vertical left and right sides, and an upper third with slanted sides and a horizontal top. The lower third of the void shown at the bottom of figure 11 is 4 weft pattern steps high, the center third is 6 weft pattern steps high, and the top third is 4 weft pattern steps high. The octagon made by pairs of gold wefts is 7 weft pattern steps high in the lower third, 12 weft pattern steps high in the central third, and 7 weft pattern steps high in the upper third. Both components are 20 warp pattern steps wide. For the remainder of this discussion, when I refer to a width in terms of

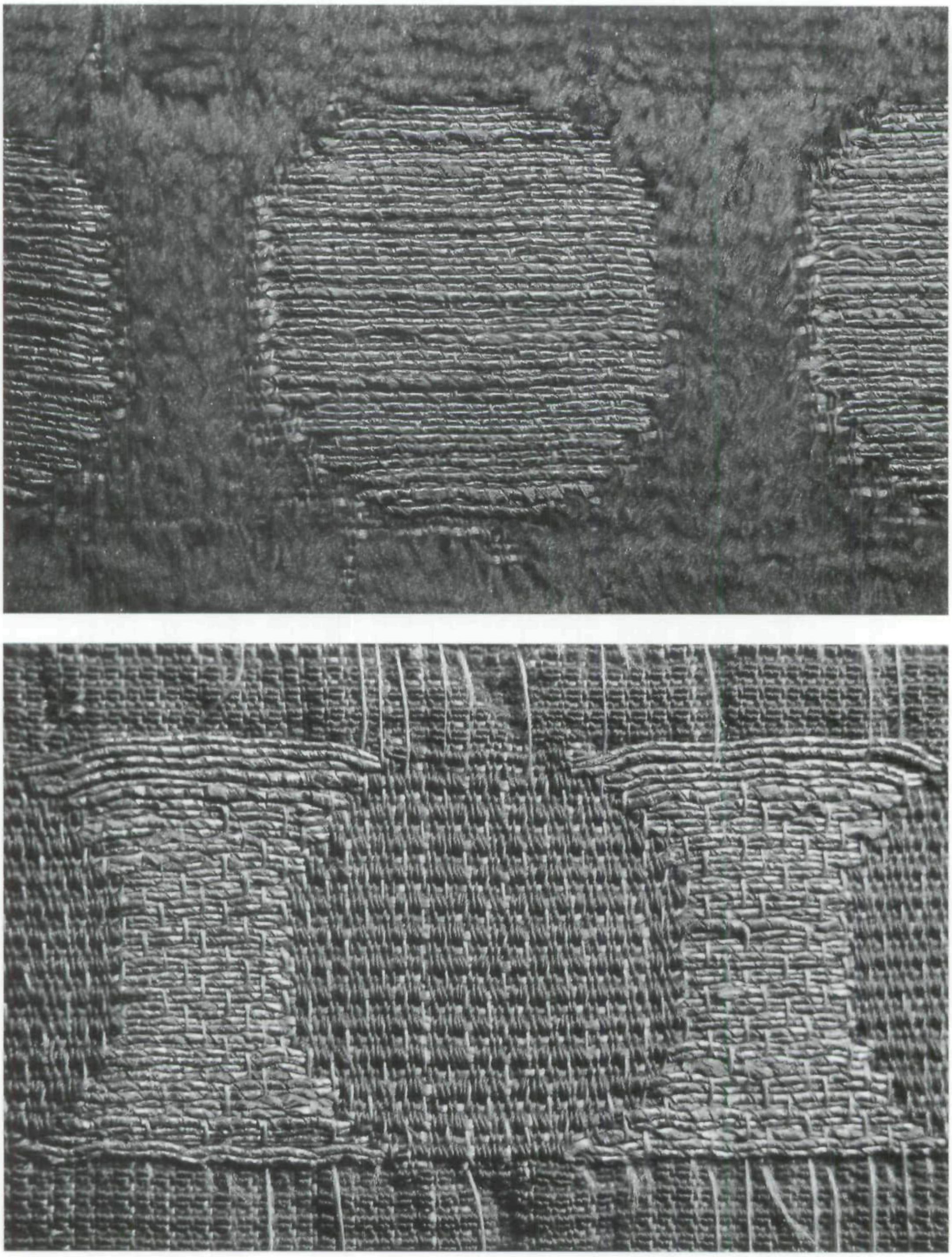


Fig. 20. Detail of the front (top) and back (bottom) of a disk in figures 1 and 2.

warp pattern steps, I will indicate the alternation of pile and non-pile warps as, for example, in this disk: 20 & 20. The disk, specifically its components, can be divided into equal halves vertically and horizontally. Were the vertical lines that divide the disks of Cooper-Hewitt 1902–1–385 also the axes of mirror-imaging used for weaving them? Were pattern sheds used in reversed order on horizontal axes? These questions forced me to examine more disks in this and additional pieces.[10]

Figure 20 gives close-up views of the front and back of a disk. These are schematically interpreted from the back in figure 21. Here the dots on the grid plan in the lower diagram indicate which pile warps were pulled up on the *front* to make pile. The vertical lines represent the pile warps that were not pulled up, thereby creating the void. The dots on the grid plan of the gold disk shown at the top of figure 21 show which warp pattern steps (each step being a pile warp pair and three non-pile warps) were selected to position pairs of gold wefts to the *back*. The verticals are the warp pattern steps that were not pulled up to position gold wefts on the *front*. The actual gold wefts that should be seen on the back, those that form the hourglass-shaped spaces between gold disks, are not shown because they would cover the dots indicating the warp pattern steps that were lifted.

I was not surprised to find that the contours of disks in other rows of Cooper-Hewitt 1902–1–385 are slightly different from what is shown in figures 11 and 21. If a repeat unit contains a disk or disks for both rows (fig. 25a-e), it is reasonable to anticipate that the two disks will be different. I was surprised, however, that I found variations on other rows as well. Figures 22 and 23 show differences in the upper third of the void. Figure 24 shows a difference in the upper third of a gold disk. This new information suggested that the disks could have been mechanically mirror-imaged on vertical axes as suggested, and that they would not have been mirror-imaged horizontally. Since disks are different in various rows, it seemed that the pattern sheds were not fixed or pre-programmed, but selected freehand. To a considerable degree, this qualifies our perception of what constitutes a repeat unit. Little did I know that I had only begun the recording of the contours of disks, a project that quickly became both time-consuming and challenging.

Since I wanted to record the edges of disks, I had to cope with irregularities that included the chronically loose and often very slack tension of pile warps, loose tension of non-pile warps, pile seemingly occurring in odd places, and gold wefts extending too far or not far enough into an edge of a disk. Eventually I was able to distinguish random irregularities from those that seemed to repeat. Ordinary random irregularities included pile warps that were inadvertently not raised when perhaps they should have been, or raised when perhaps they should not have been. Some examples of the pattern had more mistakes than others. I hoped that some irregularities that seemed to repeat would provide clues to a repeat system, the size of the repeat unit, and how many disks the unit contained.

Because overhanging pile obscures many of the edges of the disks I studied, I chose to chart contours on the back. Chris Verhecken-Lammens working in Brussels, on the other hand, studied disks from the front, because the edges of gold disks of Brussels TX 464 are separated from the voided area of the velvet by a narrow margin (fig. 3), thereby giving her access to the edges of the void and edges of the gold disk from the front. For the purposes of this section of my study, however, it does not really matter whether the contour of disks was plotted by looking at the front or back of the fabric, since each approach has its limitations.

For convenient recording, rows of disks were numbered consecutively so odd and even rows could be compared by aligning them one above the other. Numbering was, of course, arbitrary. Attempts were made to answer the following questions:

- Can mirror-imaged or straight repeats be proposed and/or confirmed?
- Are disks in the offset odd and even rows the same or different?
- In the case of a straight repeat, do the disks in odd and even rows alternate "a"/"b"?
- Are the two rows of disks—odd/even—that make up a basic repeat unit the same, or are disks in subsequent odd and/or even rows different?
- Can it be determined if pattern lifts were pre-programmed and fixed, or selected by hand?

To present contour diagrams of all the disks I studied would be impractical; three summaries demonstrate how a careful study and recording of contour edges can provide answers to the questions posed (see appendix).

Making A Pattern: Repeat Units and Repeat Systems

Repeats have two fundamental aspects: the threading of warps and the making of pattern sheds. Once a repeat system is programmed by means of threading warps into the loom's repeat system, it is impossible to change unless the loom is rethreaded, a time-consuming task that is generally avoided in traditional manufacturing workshops. Once set into the loom, repeat systems can repeat a unit containing one or motifs in one of two ways. Units can be mirror-imaged across the width of a warp (fig. 25a–c) or set side by side and in the same position or straight across the warp (fig. 25d, e).

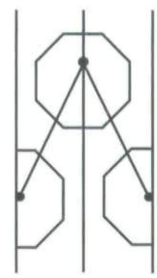
The diagrams in figure 25a–e illustrate how the repeat unit of a pattern with offset rows might be repeated. The options are as follows:

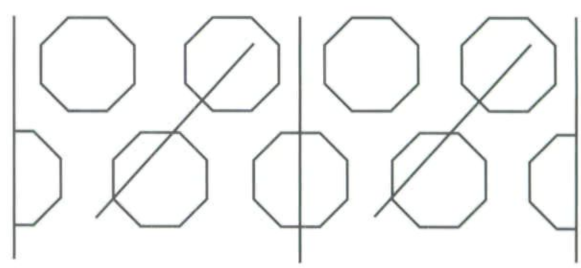
a. Repeat unit with half of a disk from each row mirror-imaged on vertical axes.

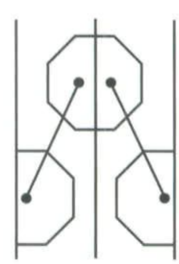
b. Repeat unit with a full disk from each row mirror-imaged on vertical axes.

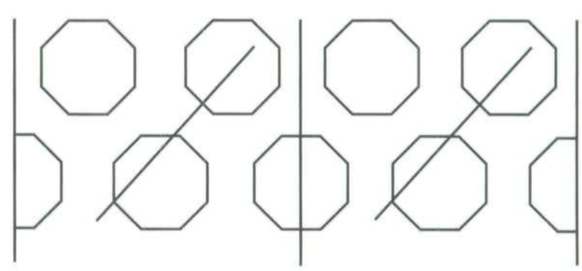
Table II. Variations in the width of disks and the spaces between them, measured in terms of warp pattern steps, and the repeat system of each type.

Collection	Warp Pattern Steps Disks	Warp Pattern Steps Space
Cooper Hewitt, 1896-1-59	19 & 19	7 & 7
Boston MFA 93.376	19 & 19	7 & 7
Cleveland 1918.30c	20 & 20	6 & 6
Cleveland 1918.30b	20 & 20	6 & 6
Cleveland 1918.30a	20 & 20	6 & 6
MMA 46.156.72	20 & 20	6 & 6
Cleveland 1918.225	20 & 20	6 & 6
Brussels TX 464	20 & 20	8 & 8
Cooper Hewitt 1902-1-385	20 & 20	8 & 8
V&A 545b-1884	20 & 20	8 & 8
Hispanic Society H955 (no.1)	20 & 20	8 & 8
Hispanic Society H955 (no. 2)	20 & 20	8 & 8
Hispanic Society H955 (no. 3)	20 & 20	8 & 8
Brussels TX 465	17 & 17 or 18 & 18	7 & 7 or 8 & 8









c. Repeat unit with two full disks from each row mirror-imaged on vertical axes. More than two disks could be included in the unit.

d. Repeat unit with one full disk from each row set side-by-side or in a straight repeat.

e. Repeat unit with two full disks from each row in a straight repeat. More than two disks could be included in the unit.

In order to identify mirror-imaging on vertical axes, one must find the same irregularities repeated on both sides of an axis. Note the dots representing a repeated irregularity in figure 25a-c.

In the case of a straight repeat, one must find irregularities that occur only on one side of a disk. Note the dots representing an irregularity in figure 25d and e.

My survey of the pieces available to me revealed that two of the above repeat systems appear to have been used: figure 25a, showing mirror-imaging with axes that fall on the center line of all disks; and figure 25e, showing a straight repeat with two disks of both rows in the repeat unit.

To achieve mirror-imaging, heddles on any number of shafts can be threaded in reversed order in two ways. Reversed threading is often called pointed, referring to the point at which threading reverses. The points of reversal position the axes of mirror-imaging. In the survey of the width of disks and the hourglass-like spaces that separate them, three groups emerge (Table II). In the first group, disks are 19 & 19 warp pattern steps wide and the spaces 7 & 7. In the second group, disks are 20 & 20 warp pattern steps wide and the spaces 6 & 6. In the third group, disks are 20 & 20 warp pattern steps wide and the spaces 8 & 8. The threading for the three groups is shown in figure 26a–c.

Starting with the sketch in figure 26a, disk width (20 & 20) plus space width (6 & 6) equals 26 & 26. Since mirror-imaging cuts the numbers in half, or into two groups of 13, two sets of 13 shafts are needed to weave these disks. The threading at the top of figure 26a represents the threading of either a void or a gold disk, but not both. The dots show that a pair of pile warps, for instance, is pulled through a heddle on that particular shaft. Threaded warps are divided into groups to demonstrate how they are related to spaces and disks. From left to right, 3 shafts are threaded Z and the same 3 shafts threaded S. These are the 6 warps (6 & 6) for a space. The next 10 shafts are threaded S in continuous order and the next 10 in a reversed continuous order, or Z. These are the 20 warps (20 & 20) for a disk. Z-threading continues for the last three shafts and that threading is reversed, or S, on the same three shafts for another space. Axes of mirror-imaging fall between the two warps that are the points of reversed threading orders. These points could be called the double points.

The sketch in figure 26b is essentially the same as that in figure 26a. It also has double pointed threading, this time on 14 shafts. The spaces are 8 warp pattern steps wide (8 & 8): 4 on each side of the axis of mirror-imaging. The disks are 20 warp pattern steps wide (20 & 20): 10 warps on each side of the axis.

The sketch in figure 26c, like that in figure 26b, has 14 shafts. These shafts, however, are threaded in reversed order with the point of reversal on a single warp. Axes of mirror-imaging, therefore, fall on a warp, not between warps as in the diagrams of figure 26a-b. With single points, spaces and disks are an odd number, in this case, 7 and 19 respectively.

In the sketches in figure 26a-b, spaces and disks are divided into two equal mirror-imaged halves with one half threaded Z and the other S. The mirror-imaged halves of spaces of figure 26c share the point at which the Z-and S-threadings overlap or connect. I have found double-and single-pointed threading reversals in mirror-imaged fabrics in many different cultures and periods, but nothing is known about their significance or meaning and, to my knowledge, their occurrence has not been published.

It must be noted that any number of warp pattern steps can be included in a unit that is to be repeated in the straight manner and that the same number of warp pattern steps is repeated in continuous order across the width of the warp.

Turning our attention to the second aspect of repeats—the making of pattern sheds—we now consider how a disk is created on a loom of a somewhat specific type.

Of the many looms with pattern devices that exist today, two can be imagined as appropriate for the weaving of this lampas/velvet. One is used in India and Iran, the other in Morocco.[11] Both have a set of shafts for basic structure plus another device for pattern. Everything needed for the basic structure—shafts, heddles, treadles, etc.—is termed the structure harness, and everything needed for pattern is termed the pattern harness. The structure harness is close to the weaver; behind it is the pattern harness. The movement of shafts in the structure harness is

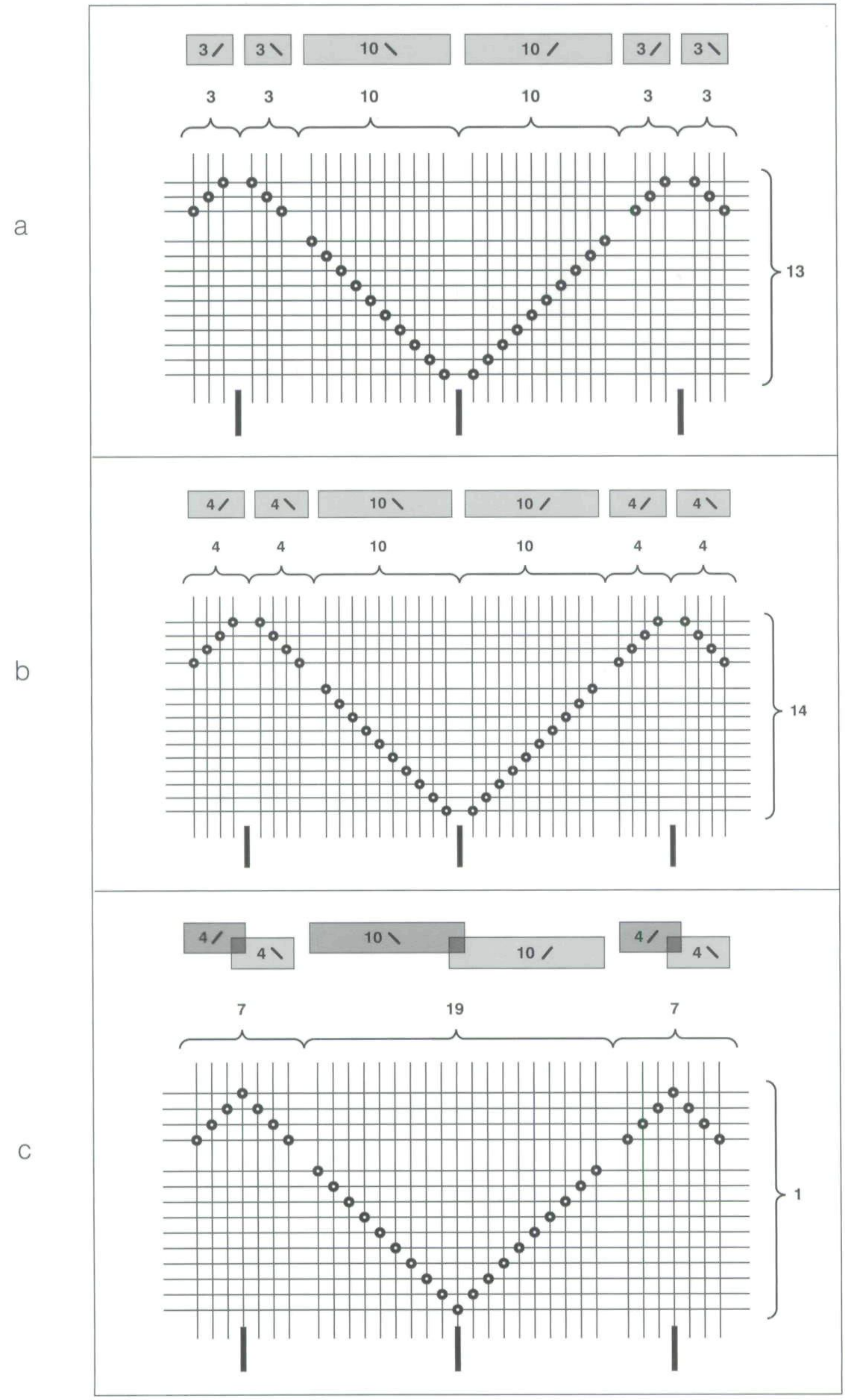


Fig. 26. Diagrams showing two types of threading for mirror-imaging the three types of mirror-imaged disks shown in Table II: (a) disk: 20 & 20 warp pattern steps wide, space: 6 & 6 warp pattern steps wide; mirror-imaging on double-pointed axes; (b) disk: 20 & 20 warp pattern steps wide, space: 8 & 8 warp pattern steps wide; mirror-imaging on double-pointed axes; (c) disk: 19 & 19 warp pattern steps wide, space: 7 & 7 warp pattern steps wide; mirror-imaging on single-pointed axes.

controlled by the weaver. In both types of loom, the pattern harness is activated by a second person called the drawboy. An outline of the way these pattern harnesses work is in order.

The pattern harness of the Indian and Iranian loom consists of two sets of cords positioned above the warp. One is a set of horizontal cross cords just above and at right angles to the warp. The other is higher, a vertical set of pattern cords of an equal number, the bottom ends of which are attached to the cross cords. Both are tightly stretched and arranged in a configuration that resembles an inverted T. The horizontal cross cords are secured beyond the sides of the loom at left and right. The set of vertical pattern cords are kept taut, secured to a point far above the loom, their bottom ends attached to an equal number of horizontal cross cords. The drawboy sits above the level of the horizontal cross cords facing the vertical set of pattern cords, which are within easy reach. He also faces the weaver, who is seated at the cloth beam. To make a pattern shed, the drawboy pulls selected vertical pattern cords toward him, which singles out equivalent cross cords that are now slightly raised. The weaver, using a large and carefully balanced leveraging hook suspended above the cross cords, inserts the long pointed fingerlike end under the slightly raised cross cords and leverages them up by pulling down on the handle of the hook. The unique balance of the leveraging hook keeps the pattern shed open so the weaver can insert a pattern weft in the pattern shed that is now held securely open by the balanced hook.

The pattern harness of the Moroccan loom also has two sets of cords, but their configuration represents a proper T and is slightly more complex. The top ends of the vertical set of pattern cords are attached to a horizontal set of an equal number of cords. The drawboy is seated at the side of the loom facing the vertical set of cords, which are within easy reach. The horizontal cords are secured far off to the side of the loom beyond the drawboy and above him, also within easy reach. They are stretched across the top of the sets of warps on the loom where they are held in place until they angle down 45 degrees and are attached to the pattern shafts. To make a pattern shed, the drawboy reaches forward and pulls selected vertical pattern cords toward him. This "draw" singles out and slightly lowers equivalent horizontal cross cords, which he pulls down, thereby lifting corresponding pattern shafts. The drawboy keeps the pattern shed open, leaving the weaver free to insert the pattern weft.

Figure 27 is the lifting plan for the mirror-imaging of a repeat unit as shown in figure 25a. The repeat unit, 28 & 28 warp pattern steps wide, is that of a disk in a velvet at Cooper-Hewitt (1902–1–385; fig. 1). In figure 27, pairs of pile warps and units of three non-pile warps alternate, and each is represented by single alternating verticals. Dots with white centers represent lifts of pile warps only to make the pattern shed for the rod that forms loops. Smaller dots represent the lifts needed to position pairs of gold wefts to front or back.

Because two techniques—velvet and lampas —were used to pattern, a set of shafts or cross cords was no doubt needed for each. The warps for pile were pulled through heddles attached to the appropriate number of shafts or heddles attached to the cross cords of one set. The non-pile warps were pulled through heddles attached to the appropriate number of shafts or heddles attached to the cross cords of the second set. The number of shafts or cross cords in the two sets was determined by the number of pile and non-pile warps in the width of the pattern unit. The order in which heddles were threaded was determined by the repeat system—straight or mirrored—that was set into the warp.

Figure 29 shows only the pattern harness of a loom. To simplify the discussion, I will use the lifting plan shown in figure 28 that is 6 & 6 warp pattern steps wide. There are 6 cross cords or shafts for pile warps at the top of the plan and 6 below that for non-pile warps. The verticals to which they are attached represent the sets of pattern cords that are within reach of the drawboy described earlier. In the Indian loom, the drawboy sits above the warps, the set of pattern cords is equivalent to the stem of the inverted T, the cross cords forming the cross of the inverted T. In the Moroccan loom, the drawboy sits to the side of the loom. The set of pattern cords is equivalent to the stem of the T and the set of horizontal cords to which shafts are attached is the cross of the T. Any number of pattern cords can be pulled at once causing corresponding cross cords or shafts to be raised and with them the heddles through which warps were threaded. This plan shows two sets of vertical pattern cords, one for making pattern sheds for pile rods and the other for making pattern sheds for pairs of gold wefts.

The heddles of the pattern harness are threaded for mirror-imaging with double pointed axes, or along lines that fall between warp pattern steps. Because the axes that extend through the

length of the fabric fall in the centers of disks and the spaces between them, they cannot be identified visually. Axes can only be deduced by counting warp pattern steps (as already demonstrated). Pairs of warps that make pile are threaded through heddles of the 6 cross cords or shafts indicated at the top. Non-pile warps are threaded through heddles of the other 6 cross cords or shafts.

For the first weft of the disk shown in figure 29, a pair of gold wefts, the drawboy pulls 4 pattern cords to lift 4 corresponding cross cords or shafts in the pile-warp set and all the pile warps threaded through the heddles attached to them. The drawboy also pulls 4 cords to lift 4 corresponding shafts in the non-pile-warp set and all the warps threaded through heddles attached to them. This creates the shed for the pass consisting of a pair of gold wefts. The next shed is for a pile rod for which the drawboy pulls 4 pattern cords to raise 4 pile shafts or cross cords and all the heddles attached to them. Subsequent pattern sheds for gold and pile are created in a like manner.

Pattern plans such as those shown in figures 27 and 28 could have been within sight of the drawboy or memorized. Reading or following the plan from right to left and making sheds accordingly completes one row of disks. By reading it again, but this time from left to right and making sheds accordingly, the next row of disks will be offset.[12] We can easily imagine that many mistakes can be made while reading the pattern plan in this manner. As pointed out earlier, disks in sequential offset rows are often different.

Was the pattern plan in the mind of the drawboy, or was it in front of him to read? Was the pattern plan read so the pattern could be programmed onto the set of pattern cords and then put aside, or was it referred to during weaving? A pattern is generally programmed by interlacing threads on the pattern cords in the order set out in the pattern plan or the repeat unit with the number of threads equal to the number of pattern sheds indicated on the plan. The repeat unit shown in figure 30 requires 80 lifts or interlaced pattern threads—40 for one row of disks plus another 40 for the offset row. The repeat unit shown in figure 31 requires 40—20 plus 20. If the pattern was programmed and therefore fixed, irregularities such as adding or leaving out pattern sheds can be anticipated. If pattern sheds for disks were selected freehand, pattern cord by pattern cord, all sorts of irregularities in contour could occur.[13]

Figure 30 shows the precise layout of two offset disks of what was earlier called the disk of a basic type, in Cooper-Hewitt 1902–1–385, the pattern plan of which is shown in figure 27. The disks in offset rows are perfectly centered because of mirror-imaging as in figures 25a and 29.

The centering of two disks in a repeat unit to be repeated straight across the width of sets of warps must be discussed in different terms. The number of warp pattern steps in the repeat unit does not modify the system as it did in the mirror-imaging system. The same number of warps per repeat unit is threaded in continuous order, unit by unit, across the full width of the warp. Referring to the 6 pieces with disks that are 20 warp pattern steps wide and have hourglass-shaped spaces that are 6 warp pattern steps wide, there are 52 warp pattern steps in the repeat unit as demonstrated in the sketch of figure 31a. This number, 52, can be divided into 4 equal sections, each having 13 warp pattern steps. Centering lines fall between warp pattern steps 13 and 14, 26 and 27, 39 and 40, 52 and 1, etc. Disks can be centered on these lines in offset rows with 6 warp pattern steps between them in both rows. Even though the middle sections are centered, this does not necessarily mean that the starting and ending horizontals are centered as well. One can expect to find this variability in symmetrical motifs in a straight repeat. The width and pile count of the 5 pieces in this group are within a reasonably close range and could have been woven on the same loom or looms with a similar set-up.

Turning to Brussels TX 465 and the sketch in figure 31b, we can see that 50 warp pattern steps can be divided into two equal sections of 25 warp pattern steps each. Centering lines fall between warp pattern steps 25 and 26, 50 and 1, etc. Disks that are an even number of warp pattern steps wide can be centered on these lines: in this piece the disks in the bottom row are 18 warp pattern steps wide and the spaces between them are 7 warp pattern steps wide. Because 50 cannot be divided into 4 equal parts, or 25 into 2 equal parts, disks in the next or offset row, which are alternately 17 and 18 warp pattern steps wide, must be centered on warp pattern steps 13, 38, etc. Disks that are 17 warp pattern steps wide are perfectly centered, but disks that are 18 warp pattern steps wide are not. The spaces between disks are alternately 7 and 8 warp pattern steps wide.

Variations in the number of warp pattern steps of disks and the spaces between them noted in two pieces in The Textile Gallery,

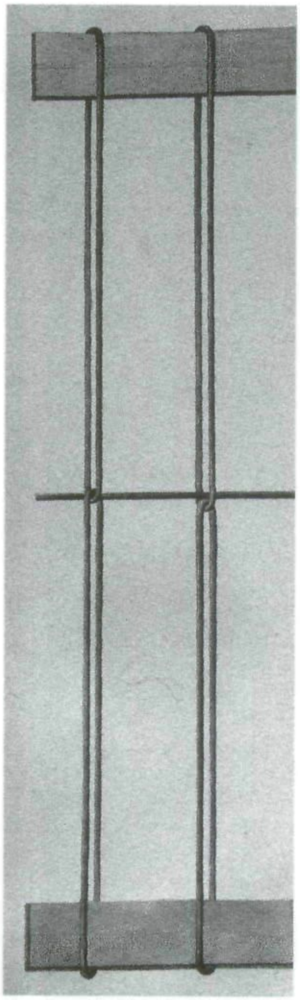


Fig. 32. Detail of a drawing in nineteenth-century weaver's thesis book, showing two types of heddles: (left) two linked looks with a warp threaded through both loops; shafts with heddles threaded in this way can lift or lower warps; (right) two linked loops with a warp threaded through the open space of the top loop; shafts with heddles threaded in this way can only lift warps. Cooper-Hewitt, National Design Museum, Smithsonian Institution, New York, 1957-201-1, Gift of Harvey Smith.

London, suggest that their repeat units might contain more than two disks in each row. Unfortunately, the pieces are not large enough to confirm this possibility.

Statements about repeat systems can be made with a fairly high degree of certainty, but proposals for pattern selection must be offered with extreme caution. The detection of a pattern selection method requires the study of many disks, more than might be available because of the size of a piece, or than can be managed within time constraints. Keep in mind that once a repeat system is set into a warp, it cannot be changed. Pattern selection methods are more flexible, as are all aspects of weaving having to do with wefts, the subject of the next section.

Weaving a Lampas/Velvet

Figure 33 presents a theoretical plan for weaving the lampas/velvet. The previously described pattern harness consists of two sets of cross cords or shafts (shown at the top), and two sets of corresponding vertical pattern cords that, when pulled, raise selected shafts or cross cords (shown at the far right). The structure harness, consisting of two sets of shafts, is shown below the pattern harness.

The structure harness consists of three shafts for the warps of the 3-unit twill[14]—the supplementary weave of the lampas—and three shafts for the pile and non-pile warps, which together make the plain-weave foundation of the lampas. The pile and non-pile warps are threaded through heddles with open tops, such as the top of two linked loops (fig. 32, right). Such heddles are indicated as a V. This type of heddle is required because pile and non-pile warps are lifted not only for the plain weave, but also for the pattern. In order for warps to be lifted by pattern shafts, their movement cannot be restricted by heddles in the structure harness. When lifted by pattern shafts, pile and non-pile warps can be lifted into the upper open part of the heddle loops. Since warps of the twill are not included in the pattern lifts, they are shown threaded through eyes of heddles, or through both loops that are linked to make a heddle (fig. 32, left), on another set of shafts.

The lower half of the pattern plan of figure 28 is what is shown being woven in the weaving plan of figure 33. The first weft is a pile rod for which all pile warps were lifted. This could have been accomplished by pulling all the pattern cords to raise all corresponding pile shafts in the pattern harness. But I am suggesting that a third shaft for the plain weave in the structure harness could be used to raise all pile warps. All of them must be raised in any case to be included in the plain weave along with non-pile warps for over-one/under-one interlacing. I am proposing a lifting system for these three shafts, each shaft to be raised by depressing one of the attached treadles by means of some sort of leverage system.

Three sheds of plain weave follow a full row of pile. Only one shaft needs to be lifted for the first and third sheds. Lifting two out of the three non-pile warps in each group of three makes these sheds. Two shafts must be lifted for the second weft, and it is this shed that includes all pile warps and one non-pile warp out of each group of three.

Another full row of pile follows and after that the first pattern shed—a shed for a pair of gold wefts to start the disk. For this shed, as demonstrated in figure 29, four pile and four non-pile pattern shafts are lifted, and, in addition, one of the three shafts of the twill in the structure harness. Weaving continues in this manner and can be followed with patient reading of the lifts required of the structure as well as the pattern harness, as indicated on the weaving plan (fig. 33).

The two most obvious features of this lampas/velvet can be seen on the back (fig. 20). First, gold wefts were used only where needed for rows of disks and, therefore, in bands as wide as the height of disks. The narrow bands between rows of disks consisting of full rows of pile did not require pattern lifts for gold wefts and possibly not for pile, as suggested earlier. The number of rows of pile in the unpatterned bands is usually consistent in each piece but sometimes may be off by one. Secondly, the set of warps of the supplementary twill float free of the foundation and over the bands between rows of gold disks. This indicates that the raising of shafts for twill had been temporarily suspended. The floating twill warps were subject to wear because of their length (about 4 mm), and they are often missing.

We will now examine the way in which the twill is attached to the plain weave with pile. It is up to the weaver to determine precisely where the twill warps begin interlacing with wefts of the foundation plain weave. There are three basic choices. First, beginning with the first pair of gold wefts (fig. 34a); second, beginning with one foundation weft before gold wefts (fig. 34b); third, beginning with two foundation wefts before gold wefts (fig. 34c). Variations such as these occur during weaving and have nothing to

do with the setting up of warps; more than one variation occurs in the same cloth. The basic possibilities apply no matter where the first pair of gold wefts is placed—whether in the pair of vise-wefts of shed "a" of the plain weave or after the pair of vise-wefts and before the weft of shed "b".

The eccentric interlacing order of the twill warps with the wefts of the plain weave makes sense when we consider it from the point of view of the weaver. Once begun, the anticipation of a shed for a pair of gold wefts could well have been the clue to the weaver that the next twill shed is to be added to the pattern shed.

The effect of reintroducing the warps of the twill is most interesting when studied carefully on both front and back. The interlacing sequence of the warps of the twill with pairs of gold wefts on the front is 1&2 (that of the weft-float face), with the sequence including one or two foundation wefts. Since warps of the twill float over no more than two or three wefts, the pairs of gold wefts are held in horizontal weft-order positions. Such is not the case on the back.

On the back, the interlacing sequence of the supplementary twill is 2&1, over two pairs of gold wefts and under one (that of the warp-float face). The warps of the twill pass over a total of five wefts: two pairs of gold wefts and three foundation wefts. This allows some flexibility in the horizontal weft-order positioning.

Sometimes the first pair of gold wefts or the pair that is the bottom edge of the hourglass shape on the back is curved and sometimes it is horizontal. The same is true for the last pair of gold wefts or the pair that is the top edge of the hourglass. It would be possible for both the bottom and top edges to be curved or for both to be horizontal, or for one to be curved and the other horizontal. These variations were noted in some of the pieces I studied but not always in detail. The models in figure 35a-c show three variations. The first or last pair of gold wefts either curves or is held in a horizontal position whether or not the pair is between the pair of vise-wefts of shed "a" of the plain weave or after the vise and before shed "b" of the plain weave. We will look first at the bottom edge of the hourglass shape.

In the model shown in figure 35a, every third warp of the set of warps of the twill that was floating above the band between the previous row of disks starts the reintroduction of the twill in the next row by interlacing first with a pair of gold wefts and then the second weft of the pair of vise-wefts. In this model, the first gold pair is between vise-wefts of the foundation. The pair of gold wefts curves down for two reasons: first, because the one out of three warps of the twill that starts the twill interlacing sequence places the pair of gold wefts over these warps; second, because the other warps, not having begun their interlacing, are seamless continuations of the warps that had been floating across the back of the band that separates the rows of disks. Thus, nothing holds the pair of gold wefts in place, and it is free to curve down unchecked, assuming its natural position. The curve is held in check by the degree of flexibility of the gold wefts themselves and the tension exerted on them by having been placed in the pattern shed and their being positioned alternately to the front or to the back to create the pattern.

In the model shown in figure 35b, the first pair of gold wefts is held in a horizontal position because every third warp of the twill that starts the interlacing sequence does so by first going under two foundation wefts. The gold pair is between the pair of vise-wefts of the foundation. Similarly, in figure 35c, every third warp of the twill goes under one foundation weft before the first pair of gold wefts. In this model, the first gold pair is after the vise-wefts in shed "a" of the foundation and is not free to curve down.

The last pair of gold wefts or the pair that is the top edge of the hourglass shape curves up in the model shown in figure 35a for the same reasons as the pair at the bottom edge. Every third warp of the set of warps of the twill that ends the twill interlacing sequence passes under the last pair of gold wefts and continues under two foundation wefts, thereby placing the pair of gold wefts over these warps. The other warps are seamless continuations of the warps that will float across the back of the band that separates this just-completed row of disks from the next. The pair of gold wefts is free to curve up into its natural position.

The pair of gold wefts that is the top edge of the hourglass in the models in figure 35b, c is held in a horizontal position for the same reason as the first pair at the bottom edge of these models. The one out of three warps of the twill that ends the twill interlacing sequence continues to interlace with one foundation weft in figure 35b and with two foundation wefts in figure 35c.

In the last phase of this research, the variations in precisely how the warps of the twill are made to start and stop the 1&2 twill interlacing sequence, which includes foundation wefts, came into focus. I was able to document variations in only a few pieces, including those that follow, and

I would expect there to be more variations than those presented in the following three examples.

In figure 36a, the pair of gold wefts that is the bottom edge of the hourglass on the back of Cooper-Hewitt 1902–1–385 is between the pair of vise-wefts and horizontal as demonstrated in figure 35b. The pair of gold wefts that is the top of the hourglass follows the pair of vise-wefts and curves up as in figure 35a.

In figure 36b, the pair of gold wefts that forms the bottom edge of the hourglass on the back of Cooper-Hewitt 1896–1–59 is between a pair of vise-wefts and curves down, similar to what is shown in figure 35a. Instead of going under the second foundation weft of the vise, it goes under both foundation wefts of the pair of vise-wefts. The pair of gold wefts that forms the top edge is after the pair of vise-wefts and curves up as in the model in figure 35a, although not as dramatically as at the bottom.

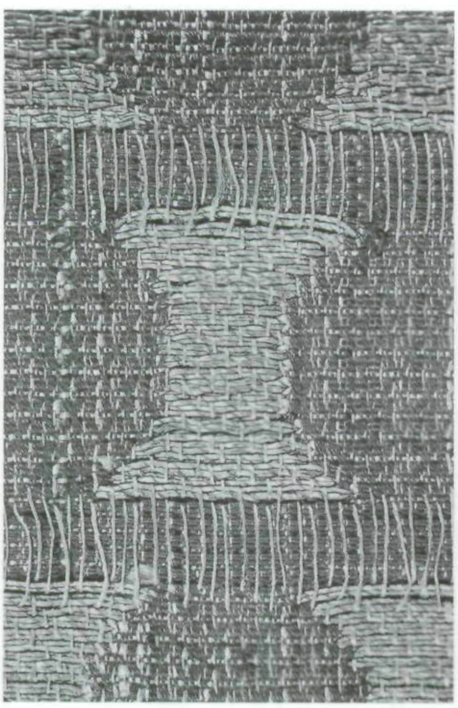
In figure 36c, a piece in the collection of The Textile Gallery, London, the first pair of gold wefts at the bottom of the hourglass shape is between the pair of vise-wefts and curves down, as in figure 35a. The weft that is the top is between the pair of vise-wefts and is horizontal, as in figure 35c.

An interesting variation is noted in Cooper-Hewitt 1896–1–59, in the fifth row of disks from the bottom. In this row, the pair of gold wefts forming the bottom edge is also between the pair of vise-wefts and is horizontal. Every third warp of the twill starts the interlacing sequence similar to what is shown in figure 38b, but instead of first going under two foundation wefts, it goes under only the first vise-weft of the pair. In addition, the first float span of every third warp is not over two pairs of gold wefts, but over one pair. Once the interlacing sequence was started, it continued in the manner already diagrammed.

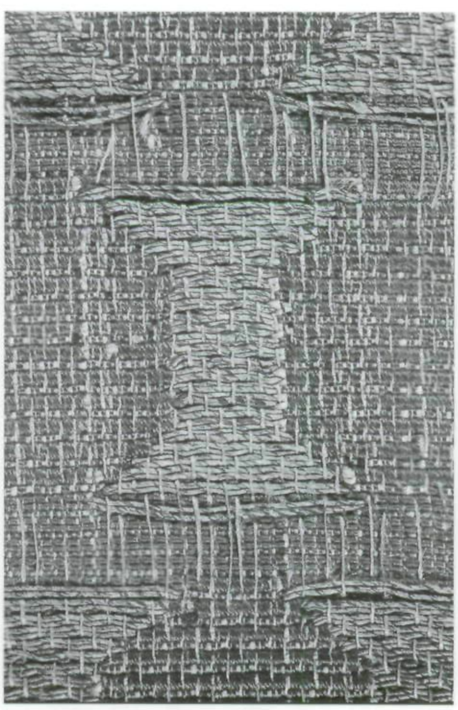
As fascinating or as tedious as the variations that concern the twill might be to record and sort out, it is variations such as these that make individual pieces distinct, especially when several occur in one piece. They provide a significant insight into how the weavers actually threaded looms and wove these lampas/velvets. I am referring again to slight differences in the setting up of looms and making sheds for structure and pattern. What at first glance appears to be a uniformly woven piece might not, when studied carefully, have been woven according to rigid modern standards. What might appear to be a closely related group of pieces might, in fact, include pieces that are different from one another yet not sufficiently distinct to define another group.

Fig. 36. Hourglass shapes between disks on the back of three pieces: (a) Cooper-Hewitt 1902–1–385: the pair of gold wefts that is the bottom edge is horizontal; the pair that is the top edge curves up (see also figures 1, 2, and 20); (b) Cooper-Hewitt 1986–1–59: the bottom edge curves down; the top edge curves up; (c) The Textile Gallery, London, no. 1: the bottom edge curves down; the top edge is horizontal. Photos by Sandra Sardjono.

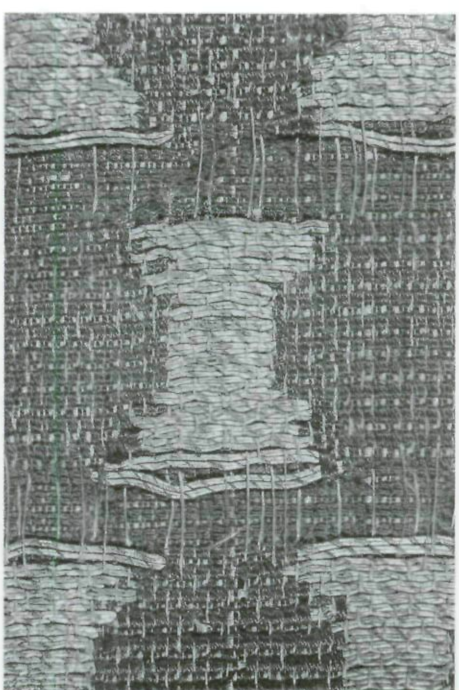
a



b



c



Width and Side Finishes

Of the five pieces that make up Bargello F127, one claims attention because of its length—it is 234 cm long—and its full selvedge-to-selvedge width of 68 cm. There are 35 complete disks in one row and 34 in the offset row, plus a half-disk at left and right. If the number of disks in a row is an indication of the full width of this group of lampas/velvets, two of the four pieces sewn together with edges turned under that make up the example in the Stibbert Museum in Florence, the back of which is not accessible, may also be full widths of about 68 cm, also with 35/34 disks per row.

The side finishes of this group of lampas/velvets can easily be identified by an approximately 5-mm wide stripe devoid of pile between the actual selvedge, or the point at which foundation gold wefts turn, and the vertical line along which pattern begins.[15] I have seen complete side finishes in six collections, but considering how many pieces exist, undoubtedly there are more. Time and conditions did not allow me to thoroughly analyze all the side finishes; I can present descriptions and a thorough analysis of one side finish that I did and one by Chris Verhecken-Lammens. It seems that in all examples, the side stripes begin—or end—on a vertical line that more or less divides disks in half.

The side finishes fall into two identifiable groups, which share common features: the warps of the stripe are various shades of blue, blue-green, or white. The warps of the stripe interlace in plain weave as in the patterned section between left and right stripes with one important modification: the elimination of warps that produce pile. The diagram in figure 5 shows how, as a result of removing pile warps, warps alternate single and paired, the pair being the foundation warps to left and right of the removed warps that would have produced pile. In addition, the warps of the stripe are doubled or tripled, somewhat disguising the fact that their number is the result of removing every fourth pile warp from the plain weave. What structurally could be said to be an alternation of single warp and a pair of warps, is now literally an alternation of a pair of warps and a group of four warps. However, some warps could be tripled. The last two warps of the plain weave are each a group of four or more. All foundation wefts and the pairs of gold wefts extend the full width of the warp and turn around the last warp at left and right. A particularly interesting feature of the foundation plain weave, however, is that two shuttles were used to carry foundation wefts (fig. 37).

Referring to figure 37a, if a single shuttle is used for a plain weave that is to have a single weft in one shed alternating with a pair of wefts in the next, every third weft-turn will be able to slip into the shed with paired wefts on its return across the width of the warp. This can occur at the left and right sides. When two shuttles are used, all weft-turns are held in place as demonstrated by the models in figure 37b-c. The difference between the two models is simply how the two wefts cross each other as a result of how the weaver put down and picked up the two shuttles one after the other. That the two sides are different in both variations is highlighted by using two colors to identify which weft was carried by which of the two shuttles. On one side, one weft-turn encloses another. On the other, the weft-turns overlap. It seemed to me that on one selvedge I saw in London, both turnings occurred on one side. I could not confirm this because of lack of time, but the model in figure 37d demonstrates how easily it could be done. Considering how many variations can and do occur in one fabric as a result of a weaver's decisions or actions, it stands to reason that what is demonstrated in figure 37d might occur in pieces of this group of lampas/velvets not yet examined.

Chris Verhecken-Lammens suggests that

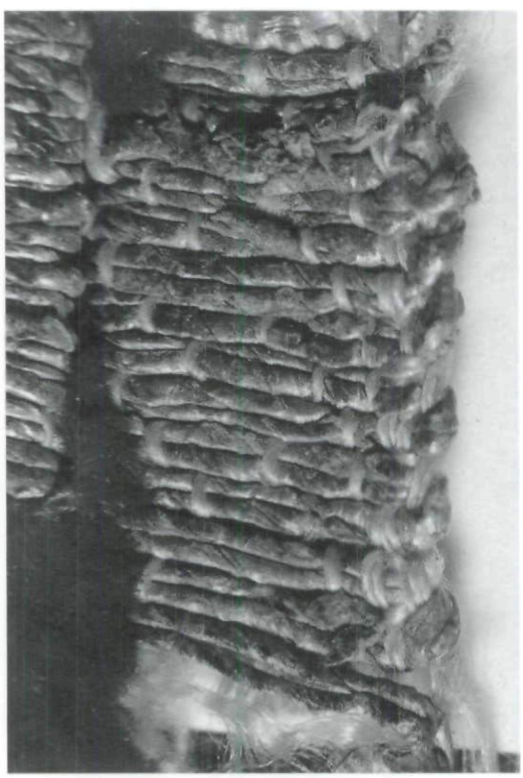


Fig. 38. Detail of Brussels TX 465 showing the side finish, approximately 6 mm wide, a stripe of white warps covered with the pairs of gold wefts of the 1&2 twill (fig. 3). Photo by Chris Verhecken-Lammens, courtesy of the Koninklijke Musea voor Kunst en Geschiedenis, Brussels.

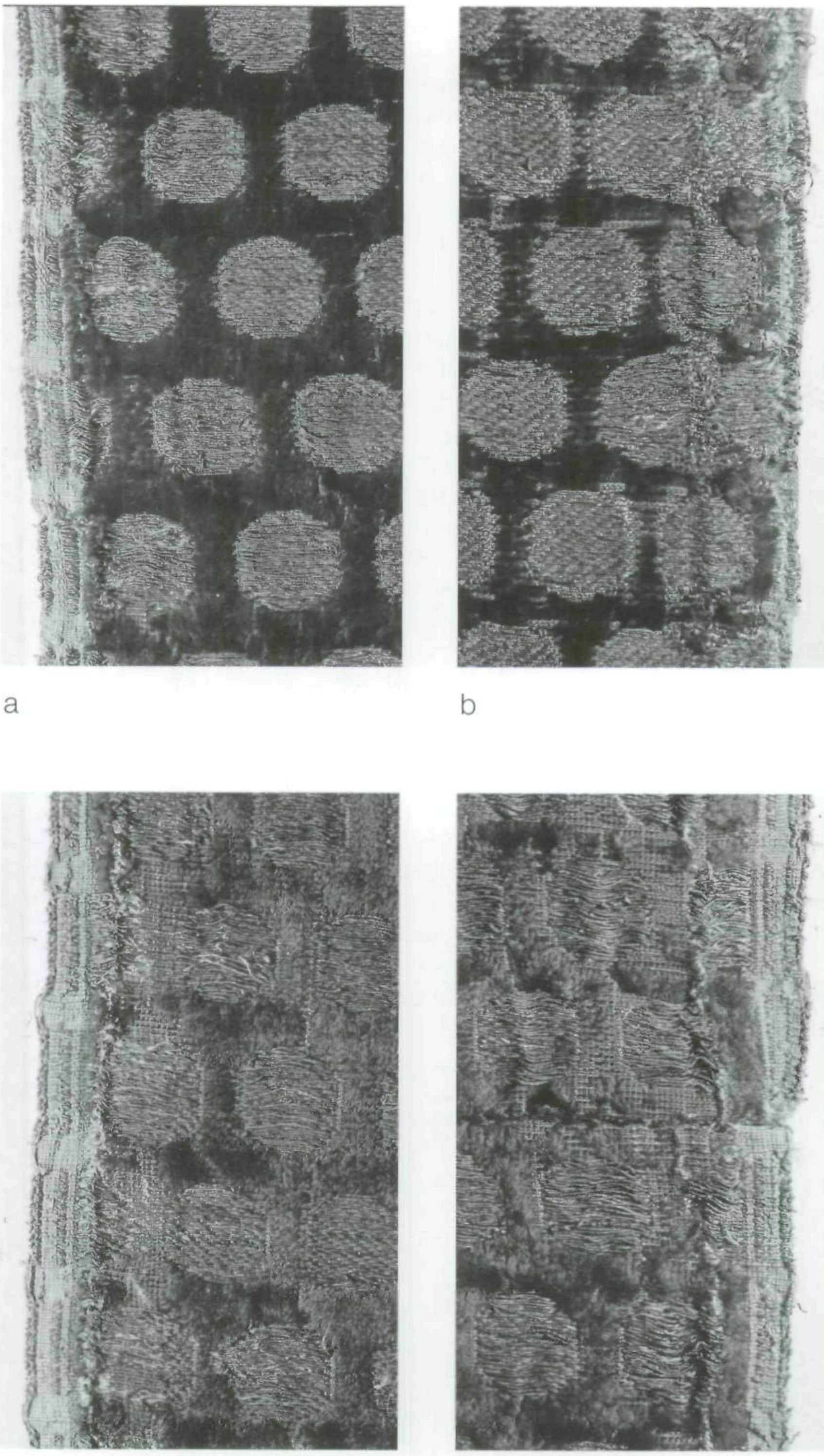


Fig. 39. Details of Bargello F127, showing side finishes, approximately 5 mm wide. Photo by Teodoro Seliantis, courtesy of the Museo Nazionale del Bargello, Florence.

"gold threads were already paired in the weft device. Of course two shuttles with gold threads can be introduced one after the other, but I doubt this was used here because you have to control two separate threads in one open shed. I rather think that the pair of gold wefts was wound around the length of a stick or flat wooden slat. You only have to unwind a sufficient length for one shed and put the stick through the shed, leaving the paired gold wefts in the shed" (personal communication).

All pairs of gold wefts turn around the last warp at left and right edges, but how they cross the side stripes accounts for two easily discernible variations. In the first variation, the pairs of gold wefts are on top of the warps of the side stripe and are bound by warps of the twill as they are in the pattern section between left and right side stripes (fig. 38). Three examples can be cited. In Hispanic Society H954, there is a short length of this selvedge on the left of one piece (no. 7). The warps of the stripe are white silk, the gold wefts of disks are bound in the Z direction, and gold wefts on the stripe are also bound Z. In Cleveland 1918.225, a tiny section in poor condition survives on the left. The warps of the stripe are blue silk, the pairs of gold wefts of the disks are bound Z, and it appears as if the pairs of gold wefts on the stripe are bound Z as well. In a third example, Brussels TX 465 (fig. 38), there is a section on the right of one of the three pieces sewn together. The warps of the 6-mm wide stripe are white silk, the pairs of gold wefts of disks are bound Z, but on the stripe they are bound S. The piece in Krefeld is described as if it is of this type with a stripe of white silk warps (Gasthaus 1979, no. 10).

In the second variation, pairs of gold wefts float on the front for short spans to form a narrow stripe, no doubt achieved by raising warps to position them on the front of the stripe. Each warp pattern step in the stripe includes only non-pile warps, the warps for pile having been removed. The patterning of the stripe eliminates the need for warps of the twill; therefore, they are not included in the stripe. It is this variation of the side finish that Chris Verhecken-Lammens and I were able to examine in detail: Brussels TX 464 and one example in the collection of The Textile Gallery, London, respectively. They are very like those shown in figure 39a–c.

In Brussels TX 464, the 5-mm wide side finish is on the left of the full length of the 34-cm long piece (fig. 3, right). The warps of the stripe are blue silk, and there is one column of gold vertical dashes that is not centered within the width of

the stripe. Five warp pattern steps were lifted to make the stripe created by gold weft floats, but there are errors. Chris Verhecken-Lammens notes that foundation wefts turn with one enclosing another (fig. 37b, selvedge on the left). The piece in The Textile Gallery, London, has a short section of this side finish on the right, the condition of which did not allow accurate warp by warp analysis. The warps of the stripe are blue silk, and there is one column of gold vertical dashes fairly well centered within the width of the stripe for which possibly two warp pattern steps were lifted. Foundation wefts turn with one enclosing another. The issue that caused much discussion and required precise analysis concerned the turning of the pairs of gold wefts. Chris Verhecken-Lammens and I conclude that gold wefts turn around the last warp only. I am not willing to speculate upon how this was managed, but Verhecken-Lammens suggests that the turn might have been accomplished by the weaver lifting the last warp thread by hand. She adds that "it seems very primitive but so is the loom" (personal communication). These are the only end finishes that were studied in detail in preparation for this paper.

Since pairs of gold wefts were used in bands as needed for rows of disks (fig. 2), the floats of gold wefts do not form a continuous stripe, but instead make short vertical dashes that are as high as the height of the disks in each row. Due to the combined thickness of the gold wefts that are paired in each shed of the twill, their turns at the outer edges are bulky and appear as another stripe—a stripe that is not the result of a pattern lift. Verticals in the side finishes are more easily read as narrow stripes that are the warps of the side finish.

Another side finish in the collection of The Textile Gallery, London, is the variation just described; it has a stripe with blue warps on the left side, but it is not easily accessible, having been turned under and stitched to adjoining fragments.

The most interesting side finishes are seen in Bargello F127 (fig. 39a-d), which is made up of five pieces sewn together. The side finishes with their selvedges are well preserved because they were never turned under and sewn into a seam. Except for one, they are flat, easy to see, and evenly straight-edged as compared to those that are so often crimped as a result of wefts having drawn warps tightly together when they turn in their passages to and fro. Four of the pieces have a total of five side finishes (fig. 39a-d); the largest piece is 234 cm in length with 5-6 mm wide selvedges on both sides (fig. 39a, b) with light blue warp stripes. The length seems to have been tacked to a flat surface, as evidenced by small holes regularly spaced on both sides. The second piece (fig. 39c) has a similar side finish on the left, 27 cm long, and may be from the same length of cloth. The third piece (fig. 39d, lower), from a different length of cloth, has a side finish 4-5 mm wide on the left, 35.5 cm long. The fourth piece (fig. 39d, upper) has a side finish 7 mm wide on the left, 16.5 cm long, but the warps of the stripe are green, and there is a pair of stripes created by floats of the gold wefts.

Four blue warps remain along a short section on the left side of Cooper-Hewitt 1896–1–59, but color alone does not indicate its side finish.

Discussion

Features that are common within limited range to all of the velvets in this survey include the following:

- gold disks are small, approximately of equal size;
- pile and non-pile warps are firmly twisted Z;
- dyes were probably cochineal for pile warps and madder for non-pile warps;
- warp and weft counts are approximately the same;
- lampas technique, with pile in the plain weave of the foundation and pairs of gold wefts in the supplementary 1&2 twill;
- gold wefts are paired in each shed of the twill;
- gold wefts are comprised of narrow strips of gilded animal material (parchment, membrane, or leather) wound in the Z-direction around a yellow (possibly also pale rose, tan, or orange) silk that has a Z-twist, with the gilded strips almost completely covering the silk.

We know that once warps are threaded on a loom, they cannot be changed without rethreading or by tying on new warps. By reconstructing the threading plan, certain features are revealed that can be used to identify different warp set-ups. They include the following:

- warp order;
- number of warps per unit of measure;
- repeat system;

- width of repeat units or the number of warp pattern steps within the unit;
- mistakes associated with warping and threading heddles.

These features can be changed only if the warps are completely rethreaded through the various heddles of a loom. Color is one feature, however, that can be changed without rethreading by tying new warps on to those already threaded and pulling them through the heddles. Similarly, by tying on, the same warp set-up can be used over and over again.

Several features that vary have nothing to do with the threading of warps and reflect instead differences in the pattern plan or the opening of sheds as controlled by the weaver. The following can be included:

- twill direction;
- the number of full rows of pile that are the bands between rows of disks;
- differences in the contour of disks and the likelihood of a fixed or a freehand pattern draw;
- the starting and stopping of the interlaced connection of the warps of the twill with the plain-weave foundation;
- mistakes associated with weaving and reading the pattern plan.

The existence of so many variations could lead to a possible but not necessary conclusion that these textiles represent a wide geographic and chronological range of production. Specific features of the variations, when considered within the three contexts just outlined—the context of the group as a whole, the context of cloths from different looms, and the context that is limited to a specific length of cloth—point to a closely defined group of cloths that are basically the same despite minor variations. A single workshop might have had many looms, some warped for straight repeats and others for mirror-imaging, each with a varying number of warps per repeat unit. Alternatively, there might have been independent workshops, each with several looms to supply a single overseer, dealer, or wholesaler with multiple lengths of a required pattern. Looms within a single workshop might have been set up slightly differently and, more likely, the set-up of the looms might have varied from workshop to workshop.

As for textiles that share technical features regardless of pattern, it is important to consider that it is much easier to re-program a pattern than it is to re-thread a loom. While such a practical approach to production may facilitate the identification of weaving centers, the practice itself makes it difficult to determine how long a specific pattern might have been woven in a certain center or specific workshop.

If we judge solely from the number of surviving textiles with gold disks in offset rows, it appears that within a particular period, this pattern was highly favored. Wardwell lists seven inventory entries that describe patterns with disks: four for Boniface VIII of 1295; one for Clement V of 1311; one in Assisi of 1341; and one in Canterbury Cathedral of 1315 (Wardwell 1988–89, p. 139, nos. 49–54 and p. 144, no. 109). One of them, no. 51 of Boniface VIII, is a red Tartar velvet with gold disks: *Item, unum pannum tartaricum pilosum rubeum ad madelias aureas.* Pope Boniface VIII consecrated Louis of Anjou as bishop of Toulouse in 1296. Louis died in 1297 and was canonized in 1317, the year of Simone Martini's altarpiece (Monnas 1993).

That Mongol silks were popular in the West is well established (Wardwell 1988–89) and vividly expressed by Lisa Monnas (1993, p. 169). In describing the fabrics worn by St. Louis and Robert of Anjou, Monnas writes:

> Both brothers are wearing "tartar silks" which were greatly in vogue among rulers of Europe during the late thirteenth and early fourteenth centuries. Thanks to the re-opening of the Silk Road under the Mongols, Oriental silks were pouring into Europe, imported by intrepid Italian merchants. Cloth also came as diplomatic gifts from the Mongols themselves.
>
> In an age when the richness of a silken cloth proclaimed the estate of the wearer, and at a time when such matters were treated with the utmost seriousness, costly tartar fabrics became an essential part of formal dress in both Oriental and Western courts. In 1332 John of Maundeville went so far as to state in his *Travels* that no foreign envoy was admitted to the presence of the Sultan of Babylon unless he were dressed in cloth of gold, or camocas, or tartar [cloth]... These materials were worn at the Angevin court of France, reaching England and Northern Europe... The depiction of tartar silks in the St. Louis panel, following the dictates of contemporary fashion, evidently constituted a display of recognizable status symbols.

The Mongols' love of cloth saturated with gold was demonstrated by the exhibition and catalogue *When Silk Was Gold* (Watt and Wardwell 1997). The large amount of gold may have been what made Mongol silks so popular in the West. The gold disks of the pattern scrutinized here may allude to small gold coins or commemorative medallions attached to a rich red cloth (Davanzo Poli 1995, p. 101, no. 83), possibly a bright insect-red plain velvet. Wardwell in "'Panni Tartarici'" writes, "The design of gold disks is very ancient in the Middle East and occurs in other media as well. But in the context of textiles, it may relate to embroideries of the 8th and 9th centuries that were known as mudannar or mufallas, because they were ornamented with gold or copper coins…" (1988–89, p. 111). However, if the pattern is thought to have been woven in Venice, the disks can be said to represent Venetian coins (Davanzo Poli 1995, p. 101, no. 83). The painting in the Uffizi mentioned earlier is a triptych, the center panel of which is filled by the standing figure of St. Matthew wearing an unpatterned red garment. It is in the flanking panels that the pattern of offset rows of gold disks is clearly depicted in two small roundels set on either side of the pointed arch of each frame (Sangiorgi 1920, p. 117). The painting was commissioned in about 1367 by the Arte del Cambio (the guild of money changers who represented the powerful Florentine banking houses), to be hung on a pillar of Orsanmichele, the church of their patron saint. The coat of arms of the guild was gold coins set on a red ground.[16]

When seen from a distance, the reflective qualities of the long lustrous red silk pile and the vibrant sparkle of tightly packed gold coins or disks must have had an effect not unlike a shimmering mirage, whether the sparkle came from real gold coins or the considerably cheaper woven gold. In spite of its sumptuous surface effect, when studied closely, the pattern of this lampas/velvet lacks finesse, as do the patterns of many Mongol lampas-type silks dominated by gold wefts. The disks of this pattern are awkwardly shaped, even when accounting for their small size. The plain weave with pile is well thought out, but as a foundation for lampas it has a number of drawbacks. The edges of disks are not smooth and weaving is complicated. The disks of a straightforward lampas without pile would have been more cleanly shaped. With pile, left and right edges are slightly different (as shown earlier), and the tops of disks have a shaggy look because of overhanging pile. While it is true that these details have little effect when seen from afar, there is, nevertheless, a certain tension between the gold and the pile.

International connections are essential to any discussion of textile motifs, techniques, or use. For example, Chinese silk threads, fabrics, and garments seem to have been imported into the Mediterranean area in the first century B.C. (Forbes 1964, p. 54), and one need hardly mention the caravan routes across Central Asia. Of particular importance to this study is the protection and relocation of textile artisans over vast distances by the Mongols in the thirteenth and fourteenth centuries. This situation no doubt would have had an impact upon the possibility that these lampas/velvets were woven within this period, and not in Spain or Italy. It is therefore important to evaluate the specific aspects of a wide range of compound silks in order to develop a broad geographic and chronological framework for this placement (Allsen 1997; Wardwell 1988–89; Watt and Wardwell 1997; Monnas 1986).

While a survey of dyes is beyond the subject of this paper and my expertise, a suggestion of geographic and chronological use of insect and madder reds up to the fifteenth century is in order. In the West, silks of thirteenth-century Spain come to mind immediately, and the use of two reds remains a distinct Spanish feature into the fifteenth century and probably later. The brightness and clarity of one of the two reds in Spanish silks suggest that the brighter red is cochineal and the duller red madder, as in three pieces of these lampas/velvets. Two reds were used in Italy in the fourteenth century, but the reds are generally not as bright and clear as the reds in textiles from Spain. Little is known about dyes used in areas dominated by the Mongols, especially during the critical period of the thirteenth century, when textile craftsmen and their expertise were relocated over a vast area including the eastern Iranian world and China (Watt and Wardwell 1997, p. 127). In the Far East, it has been noted that red dye possibilities of the Northern Song Dynasty in China (A.D. 960–1127) include madder and cochineal (Taylor 1991). Since insect reds were more expensive than madder reds, it is important to note how the two were used. In compound weave, was madder red used for a hidden set of warps, or wefts, and an insect red for those that are visible, as is the case in this group of velvets?[17]

Wardwell admits that very few silks survive on which to build definitive conclusions; never-

theless, the features she observed and worked with over a long period of time were consistent enough to construct a general outline (personal communication). One feature in particular applies to these lampas/velvets: her discussion of side finishes as well as their possible origin. The side finishes in all the silks included in Appendix I of her article "'Panni Tartarici'" (Wardwell 1988–89, p. 133; see corrected appendix inserted after publication), are described as having "borders." She points out that three of her eight categories have side finishes with stripes—categories II, IV, and V, which she attributes to Central Asia. She offers a description of a side finish that appears to be similar to the ones of the lampas/velvets described earlier: "the selvage border has paired, sky-blue main warps; in the areas where the gold wefts occur, the lines of blue warps form two stripes against the gold wefts predominating on the face. The outer selvage is completed by two bundles of warps around which all wefts turn" (Wardwell 1988–89, p. 103). Silks in category II are attributed to Central Asia. She offers a similar description of a silk in category IV, also attributed to Central Asia: "On the face of each selvage border are pattern wefts interrupted by three thin stripes of main warps. These are the same color as the rest of the main warps but are paired. Each outer edge is completed by two bundles of warps around which both ground and pattern wefts turn" (p. 105). Side finishes of silks of category V (Wardwell 1988–89, pp. 107, 108) are also striped. Stripes in the side finish of a silk in her category IV are clear in the detail photo (her figure 30A, p. 156), as are the stripes in a silk in category V (her figure 36, p. 158).

In another lampas described as Eastern Islamic, dated to the second half of the thirteenth century or the fourteenth century, the side finish on the right side has no warps of the supplementary weave.[18] It is patterned by three narrow stripes that are blue warps of the foundation weave and/or three stripes that are vertically aligned floats of metallic wefts of the supplementary weave (the number of metallic stripes includes the point at which they turn at the outer edge, or selvedge). Assuming the lampas was woven back-side up, the stripes that on the front are vertically aligned floats of gold wefts, were created by lifting warps of the foundation weave by means of the pattern harness. The same was true with the lampas/velvets, but these were woven front-side up. At the edge there are two bundles of warps that were most likely threaded through heddles of shafts of the structure harness so they interlace 1:1 with the set of wefts of the foundation weave, a 4-unit twill. However, the two bundles of warps at the edge do not seem to have been raised for the 1:1 interlacing with the set of metallic wefts of the supplementary weave, a 3-unit twill. Instead, interlacing was achieved by the weaver's hand manipulation, as noted in the lampas/velvets.[19]

Anne Wardwell is firm in her conclusion that silks with striped side finishes are not Italian or Spanish. She writes: "The selvage edges of Italian drawloom silks from this period are completed by linen cords; those of Spanish silks are also reinforced cords that are usually linen or occasionally silk. In the textiles attributed to Central Asia, on the other hand, as well as some attributed to the Middle East, the selvage edges are reinforced by bundles of silk warps, but never linen cords" (1988–89, p. 96). On the same page and in conversations with me, she emphasizes the importance of the materials of gold threads. In summary, silks woven with gold wefts used in pairs, the surface of which is gold (Indictor 1988, Table 4, p. 15 and Table 5, p. 16) and the animal substrate of which is coarse and thick, are eastern in origin. The silks in Wardwell's category VI are attributed to northeastern Iran and include a lampas/velvet patterned with offset rows of gold disks in the Cleveland Museum of Art (her figure 57, p. 165). Since Wardwell was not aware that these lampas/velvets have side finishes with stripes, this feature can be added to her category VI.

Wardwell offers various reasons why this group of velvets patterned with offset rows of gold disks is neither Italian nor Spanish. It is worth reviewing her arguments regarding their origin. She points out that a few thirteenth- and fourteenth-century travelers saw velvet in Central Asia, Iran, and Iraq. Velvet is mentioned by Rashīd al-Dīn, and a velvet is the only cloth mentioned by Ibn Battūta (p. 96). Moreover, "Ibn Battūta refers to the cloth as *kamkhā*... a Persian word shortened from *kamkhwāb*, meaning "having a little nap, or pile" (Wardwell 1988–89, note 6, p. 122). It must be said, however, that fabrics other than velvet can be described using the same terms. Wardwell attributes them to Tabriz because:

> that city not only produced luxury textiles before the arrival of the Mongols in the mid-thirteenth century, but... it was relatively undisturbed by the concomitant social and economic upheavals suffered elsewhere. Finally, this center must have

produced a variety of luxury textiles including velvet as well as lampas weaves. The only city that fits these qualifications is Tabriz. Not only was it spared by the Mongols, but it served as the Ilkhanid capital until Sultaniya was built. Yāqūt, who traveled to Tabriz in 610 H./A.D. 1213, wrote of luxury fabrics produced there, and evidence from Bar Hebraeus, 'Umari, and Bidlīsī strongly support the existence of a *tiraz* factory or workshop in Tabriz during the Ilkhanid period [1256–1349, established by Hulagu, the grandson of Jenghiz Khan]. According to Marco Polo, Rashīd al-Dīn, and Ibn Battūta, a variety of sumptuous textiles were woven there, including silk and gold fabrics and velvet (Wardwell 1988–89, p. 111).

Within the context of international contacts, Wardwell offers:

> It is interesting that Tabriz is identified in the 1295 inventory of Boniface VIII as the place of manufacture for four textiles... At that time, of course, a colony of Italian merchants was in residence there, and quantities of luxury textiles woven in Tabriz must have been imported into Europe. What is particularly interesting, though, is that they could be distinguished —at least to the eye of the compiler of the inventory—as textiles woven elsewhere (Wardwell 1988–89, n. 156, p. 129).

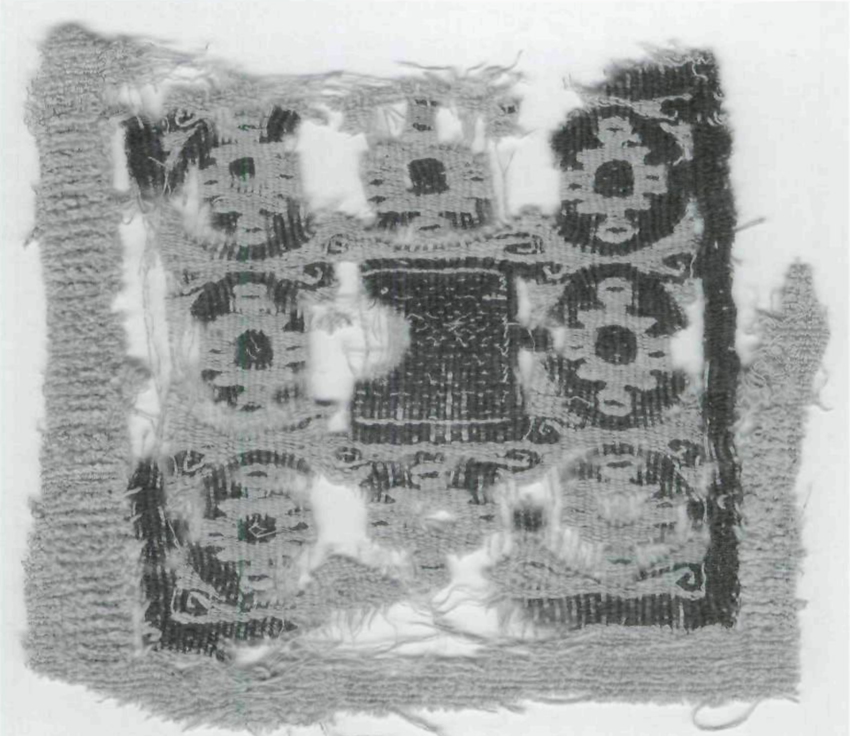
While thirteenth-century Mongol Iranian velvets are documented, it does not mean that velvet weaving originated in Iran. The two techniques that were combined to weave the pattern of this group—plain weave with pile and the lampas-type use of the gold twill—may provide a useful basis for piecing together a history of velvet techniques.

Plain weave is the foundation of this lampas/velvet. The earliest Western velvets known that are a plain weave with pile date from the Late Antique period of about the fourth or fifth century A.D. (Bellinger 1955, figs. 25–27; Kendrick 1921, nos. 301, 302, 303 on pp. 10–11, and pl. I), as shown in figure 40 (note that Kendrick does not identify these as velvet). The pile of these velvets is uncut loops of linen warps that are supplementary to the linen plain-weave foundation. They survive, not necessarily because they are velvet, but because of the purple wool and linen tapestry that is surrounded by the pile. It may be that the weaving of velvet had continuous traditions in a number of areas from as early as the Late Antique period, as evidenced by the linen velvets just mentioned. Perhaps the work of scholars of Byzantine art and history, for example, will some day link the velvets of the fifth century A.D. to other areas prior to the thirteenth century.

Unfortunately, the conventions used by early painters for plain surfaces do not allow us to be specific about the textiles they are trying to represent. Plain velvet might be what is shown in fourteenth-century Italian paintings as the fabric for garments of the Virgin and upper level clergy. What might be interpreted as the sheen of silk might just as well represent the play of light on changing directions of silk pile. If a garment worn by an important figure, however, is embroidered in what is clearly indicated as gold, it is possible that it represents an embroidered plain velvet, especially considering the later long and important tradition of embroidery on velvet—a combination of two precious materials.

There are velvets with plain-weave foundations woven within the fourteenth and fifteenth centuries (Monnas 1986; Desrosiers 1993), but this paper is not the forum for a general discussion that includes such velvets and certainly not detailed analyses of their structures and techniques.

Fig. 40. Velvet, fourth or fifth century A.D., found in Egypt: loops of a set of linen supplementary pile warps set into linen plain weave surround a tapestry-woven square with purple wool and linen wefts. The Textile Museum 71.135, acquired by George Hewitt Myers in 1955.



I interpret this velvet as a lampas to which pile was added. Lampas as a patterning technique was well established before the thirteenth century. Using the lampas technique with continuous gold wefts offered a cheaper and faster method to produce this pattern than brocading each gold disk. A significant amount of gold was saved by not using it in the bands between rows of disks. Weaving this lampas/velvet with its complicated treadlings was made a bit faster by not having the set of warps of the twill interlace with the set of wefts of the foundation between rows of disks. It is possible that techniques for patterning plain velvet during weaving by means of voiding pile and filling voided areas with metallic or silk wefts were being explored in a number of regions and cultures. It may be no coincidence that the tapestry sections of the Late Antique velvets and the gold disks of the lampas/velvets under discussion (possibly of the thirteenth century) are set in areas voided of pile, despite the differences in technique.

The use of gold wefts in velvet raises a fascinating issue. It is important to note which velvets might have had pattern lifts for metallic or silk wefts—for example, the lampas technique discussed in this paper—and which did not. In this context, I, and possibly others, have documented fifteenth-century velvets in which gold wefts were used by means that could be described as related to the lampas technique. In the future, information about how gold wefts were handled must be gleaned from careful studies of velvet, current published sources being sparse. I will summarize two examples.

Cooper-Hewitt 1902–1–876 is patterned by a bold vine curving on the Z-diagonal bearing bold flowers, of which some use wefts wrapped with foil, and others have green cut-pile with gold centers (Cox 1900, pl. XXII, fig. 7). The textile is most likely Italian and dated to the first quarter of the fifteenth century. The foundation is a green silk 4&1 satin and the gold areas are a 1&2 Z-twill with its own set of warps. The gold wefts are composed of narrow strips of foil wrapped S around yellow silk that has an S-twist. They are used singly and are not continuous across the full width of the velvet, but are brocaded in areas where required by pattern. The set of warps that binds them are set in stripes about 8 cm separated by a space 2 cm wide. The set of twill warps is attached to the foundation in a way that is completely different from that described in this paper. Foundation warps no doubt would have been lifted to position gold wefts for pattern. In this case, however, the pattern lift would not have had to include pile warps, not because gold-brocaded details are superimposed on a surface voided of pile, as one would expect, but because they are surrounded by areas voided of pile, in some cases by a wide margin.

In an article dedicated to Gabriel Vial (Sonday 1992) about a late fifteenth-or early sixteenth-century velvet, I combined the terms velvet and lampas. The supplementary weave of Cooper-Hewitt 1983–4–2 is also a 1&2 Z-twill. The yellow silk wefts of the twill continue across the full width of the velvet and remain always on the front, not on both front and back. They are hidden in areas of pile and exposed in the areas voided of pile. This combination of foundation weave and supplementary weave could fall within a definition of lampas, except that wefts of the supplementary weave act as a facing that did not require pattern lifts.

The velvets, Cooper-Hewitt 1902–1–876, Cooper-Hewitt 1983–4–2, and those discussed here, can be described as having supplementary wefts bound by a set of warps used specifically to attach the supplementary wefts to the foundation. This description could be the basis for a description of lampas. However, it does not specify that two weaves can be identified, which, to me, is one of the key features of the lampas technique. Without this feature, a set of supplementary "binding" warps can be used in other techniques. Two weaves, each with its own set of warps and set of wefts, can be identified in the velvets just mentioned—one a foundation and the other added to it, or supplementary. In the group patterned with disks, the foundation weave has warps that make pile, the 1&2 twill with gold wefts (the supplementary weave) is attached to the foundation, and the gold wefts of the twill pattern by means of pattern lifts, but in bands for each row of disks. In Cooper-Hewitt 1902–1–876, the foundation satin weave has a set of pile warps added to it, the supplementary 1&2 twill with gold wefts is attached to the foundation, and gold wefts pattern by means of pattern lifts. In this example, however, the set of warps of the supplementary twill is a series of separated stripes and the gold wefts of the twill are discontinuous or brocaded in widely separated bands as determined by the pattern. In Cooper-Hewitt 1983–4–2, the foundation has pile warps, and the 1&2 twill with yellow silk wefts is attached to the foundation. In this example, the silk wefts of the twill are continuous and used throughout the length of the cloth; because they remain always on the front, they do not require pattern lifts.

Therefore, I suggest that the term lampas is often subjective and not always definitive. An author's definition should be stated if it is not implied, as it often is, by means of the context of the fabrics discussed. I use it in this presentation for clarification, to provoke discussion, and to stimulate much-needed research on early velvets.

Summary

The technical report I offer here neither confirms nor refutes where and when the velvets patterned with offset rows of disks were woven. But these velvets may represent one of the earliest uses of the lampas technique to pattern velvet. Visual evidence that the pattern with offset rows of gold disks was used in the West in the thirteenth and fourteenth centuries has been demonstrated. References in Italian inventories of the period confirm the use of fabrics with the pattern of offset rows of disks. Judging from the number of pieces extant, this pattern was favored. Moreover, the fact that in an inventory dated 1295 one cloth is described as a Tartar velvet is backed by references to the weaving of velvet far to the east of Italy—specifically in or around the city of Tabriz. The proposal that the velvets of this group were woven in the east, in the area of Tabriz as Anne Wardwell suggests, must be accepted for now. Meanwhile, one hopes that another scholar or a team of specialists attempts the daunting task of analyzing the myriad aspects of a significant number of compound woven silks of the thirteenth and fourteenth centuries and organizes them in categories spanning the wide geographic span from Spain to China. It is in this context that I offer my detailed discussions.

Acknowledgments

I wish to thank the following individuals for making fabrics available for study, for fruitful discussions, or for photographs: Louise Mackie, Cleveland Museum of Art; Anne Wardwell, Cleveland; Constancio del Alamo, The Hispanic Society, New York; Thomas Campbell and staff of the Ratti Center, The Metropolitan Museum of Art, New York; Ann Coleman, Museum of Fine Arts, Boston; Linda Woolley, Victoria and Albert Museum, London; Lisa Monnas, London; The Textile Gallery, London; Dr. Angela Völker, Österreichisches Museum fur Angewandte Kunst, Vienna; Hans Koenig and Regula Schorta, Switzerland; Dr. Werner Adriaenssens, Koninklijke Musea voor Kunst en Geschiedenis, Brussels; Dr. Kirsten Aschengreen Piacenti, Stibbert Museum, Florence; Dr. Giovanna Gaeta Bertela and staff of the Museo Nazionale del Bargello, Florence. Working with me and Lucy Commoner, Textile Conservator, Sandra Sardjono provided charts and close-up photographs of pieces in Cooper-Hewitt. Roberta Orsi Landini, Director of the Fondazione Arte della Seta Lisio in Florence, arranged for photographs to be taken of side finishes of the textiles in the Bargello in Florence. Joyce Denney in the Department of Asian Art at The Metropolitan Museum of Art offered sensible advice on various sections of my discussion. Special appreciation is given to the editors and curators of The Textile Museum, especially Carol Bier and Mattiebelle Gittinger, for their generous support, valuable suggestions, and patience. Much of my discussion would not have been possible without the support of Anne Wardwell, who generously summarized aspects of her work for this publication.

About the Author

Milton Sonday received his early training in the field of historic textiles at The Textile Museum before becoming Curator of Textiles at Cooper-Hewitt, National Design Museum, Smithsonian Institution, in New York. He now holds the post of Senior Researcher, Textiles. At The Textile Museum, Sonday began to apply his artistic talents to the illustration of textile structures; over the years the graphic style of his diagrams has evolved. His research focuses on a broad spectrum of historic weaving techniques.

A member of the advisory council of CIETA (Centre International d'Etudes des Textiles Anciens), Sonday is also a founder of the Textile Society of America and past president.

Notes

1. An early version of this study was read at the General Assembly of CIETA in Bern, Switzerland, in September 1999.

2. For example: Cox 1900 (Venice, beginning of the 15th century); Sangiorgi 1920, p. 117 (Italy, 14th century); Errera 1927, nos. 99–100 (Italy, 14th/15th century); May 1957, figs. 146–47 (Spain, first half 15th century); Mayer-Thurman 1975, no. 44 (Spain, 15th century); Gasthaus 1979, no. 10 (Ostasien, 15th/16th century); Buss 1983, pp. 130–31 (Italy or Spain, 14th/15th century); Davanzo Poli 1995, no. 83 (Venice? 14th/15th century). A note on a catalogue card in the Cleveland Museum of Art indicates Miss Underhill changed the attribution from Turkey to Italy in 1943.

3. As of the date of this publication, examples can be found in seven museums in the United States, one museum and two private collections in London, two museums in Paris, two museums in Florence, one in a private collection in Switzerland, and one in a museum in each of these cities—Lyon, Strasbourg, Brussels, Milan, Venice, Turin, Prato, Geneva, Tarassa, Barcelona, Krefeld, Cologne, Vienna, Copenhagen, and Toronto.

4. Chris Verhecken-Lammens works with textiles in the collection of the Koninklijke Musea voor Kunst en Geschiedenis in Brussels. She and I worked together on these pieces with joyful intensity, so it is with humble thanks that I acknowledge her contributions throughout this paper.

5. Cooper-Hewitt Museum 1896–1–59, one piece; 1902–1–385, one piece; Hispanic Society H954, fifteen pieces of various sizes sewn together, some of them small, numbered by M.S. 1–15; H955, four pieces of various sizes sewn together, one tiny and one large patched with two small pieces, numbered by M.S. 1–4; The Metropolitan Museum of Art 46.156.72, one piece; Cleveland Museum of Art 1918.30a, one piece; 1918.30b, two pieces sewn together, one tiny, numbered by M.S. 1–2; 1918.225, one piece; Museum of Fine Arts, Boston 93.376, one piece; Victoria and Albert Museum 545a-1884, one piece; 545b-1884, two pieces sewn together, one tiny; The Textile Gallery, London, no number, one piece; no number, one piece; no number, 4 pieces sewn together, one much larger than the others; private collection, London, no number, one piece; Brussels TX 464, one piece; TX 465, three pieces sewn together, one much larger than the others; Bargello, Franchetti Collection (F127), five pieces of various sizes sewn together, one of them 234 cm (selvedge to selvedge), and one of them tiny; Stibbert Museum no. 16110, five pieces, each about the same size, sewn together.

6. The Italian analysis is presented as a grid of coded squares. Two velvets are illustrated, one in Museo del Bargello, Florence; the other in Civiche Raccolte d'Arte Applicata, Milan. The pile of both is red.

7. The first test was conducted by Denyse Montaguet of the Fashion Institute of Technology, New York; she used the Schweppe technique for one piece in the collection of the Cooper-Hewitt. More advanced tests of the two Cooper-Hewitt pieces were carried out by Witold Nowik at the Laboratorie de Recherche des Monuments Historiques, Paris, in cooperation with Dominique Cardon in France. Nowik's identification was based on a qualitative and quantitative investigation of the dyestuff's composition by high performance liquid chromatography separation and photodiode array detection (HPLC-PAD). He found the red or non-pile warps to have been "colored with madder (*Rubia tinctoria*) root extract. Moreover, the composition of dye in both samples is qualitatively identical and has only slightly different relative quantity of characteristic compounds." He says the red of the pile warps was "dyed with extract of carminic acid containing cochineal." Dr. Jan Wouters, head of the laboratory for materials and techniques at the Koninklijk Institut voor Het Kunstpatrimonium, Brussels, tested one piece in the Cleveland Museum of Art. He identified madder, very probably *Rubia tinctorum*, as well as Polish cochineal (*Porphyrophora polonica*) using the same technique. The cooperation of the Cleveland Museum of Art is greatly appreciated, in particular that of Louise Mackie, Curator of Textiles and Islamic Art, D. Bruce Christman, Chief Conservator, and Robin Hanson, Textile Conservator. For an insightful discussion of the current state of dye analysis, see Wouters 1993. Wouters refers to the detailed results gained from high performance liquid chromatography (HPLC) and points out that it is useful "in establishing relationships between fragments supposedly from the same textile." By extension, HPLC could help us place fabrics into groups, each dyed with like or similar materials. Based on his analysis of the two velvets in Cooper-Hewitt, Nowik says, "These velvets are probably dyed and made in either the same conditions (according to tradition) or even in the same workshop by living people. The [two] fragments could also [have] been original from one piece." While my analysis shows they are not from the same

piece, Nowik confirms they are closely related. This paper would have been greatly enriched had it been possible to analyze the dyes (not to mention the gilded animal substrate) of more of these velvets grouped by technique.

8. If the warps that produce pile are considered a separate set, then the interpretation and description of the structure of non-pile warps must be modified to indicate a pairing of non-pile warps. I am not offering this interpretation because of the many velvets in which warps that make pile are clearly a separate set, with the non-pile warps being unaffected by their one-warp-at-a-time interlacing sequence, be it plain weave, twill, or satin.

9. If warps of the supplementary weave do not interlace with wefts of the foundation weave, it is the wefts of the supplementary weave that are positioned in their paths to either front or back in their passage from selvedge to selvedge that hold the two weaves together. It must be noted that the two weaves are on separable layers in some areas. I have been describing this lampas variation as one with no interlaced connection—one that has a venerable history, a detailed discussion of which is not appropriate for this presentation. Unfortunately, there is, as of this date, no single reference that carefully illustrates and explains the two lampas variations—those with and those without an interlaced connection—nor are they generally described as such. I should also point out that not everyone applies the term lampas as strictly.

10. A line along which a motif can be divided is simply a line. An axis of mirror-imaging, by contrast, is the hinge on which repeat units fold, flip, or turn from one side to the other. I prefer to reserve use of the term "axis" for mirror-imaging resulting from mechanical or technical means built into the pattern harness.

11. To understand the Indian loom, see DuBois 1983, p. 224 (diagram), and p. 225 (photograph); see also Wulff 1966, pp. 205–10 and Becker 1987, p. 252 (color photo) and p. 259 (diagram). For good illustrations of the Moroccan loom, see Vial 1980, figs. 5, 6; for a video of a Moroccan loom in action, see Mackie 1996.

12. Reading a pattern plan for a repeat unit first from left to right and then from right to left is probably an ancient practice. By reading a pattern plan in this manner, a vertical axis is created that divides the two repeat units, now one on top of the other, in half. The two units are mirror images of each other, but their axes, instead of falling on the sides of the units, are in the middle. This axis is not mechanical as for mirror-imaging as described in n. 10. This type of mirror-imaging can be described as pivoted. For an illustration see Sonday 1987, pp. 62, 63. A pattern plan can be read in this way and repeated in the straight manner as well as mirror-imaged.

13. Rahul Jain (1995, p. 56) discusses the pattern harness and the pattern cords or "drawcords." He notes, "One variant, for example, has no drawcords and the pattern selection is made directly on the crosscords." He adds that in this example, the drawboy and the set of pattern cords onto which the patterns would have been fixed are eliminated.

14. I am suggesting three shafts for the plain weave to show that it would be possible, and for a bit of fun. It also visually emphasizes warp order—one pair of pile warps between a pair of non-pile warps—with the pile warps threaded through heddles on shaft no. 3 and the non-pile warps to left and right threaded through heddles on shaft no. 2. The foundation plain weave could just as easily have been threaded on four shafts in continuous order—1, 2, 3, 4, etc.—with non-pile warps threaded through heddles on shaft nos. 1, 2, and 3 and pile warps through heddles on no. 4. With shaft no. 4 lifting warps for pile, it would be this shaft along with shaft no. 2 that would be lifted for shed "b" of the plain weave, or alone for full rows of pile between rows of disks. Shaft nos. 1 and 3 would be lifted for shed "a" of the plain weave. Chris Verhecken-Lammens prefers the plan with four shafts, and indeed it may be more practical. In both cases, only two treadles are needed for the plain weave. The third treadle is optional for full or non-voided rows of pile if all pattern cords for pile were not used for this purpose.

15. I define *selvedge* as the point at the side edge of a fabric at which wefts turn around in their passage from left to right and right to left. A pattern may or may not continue up to the last warp, the warp at the turnaround. The term *side finish* signifies that other features were introduced. One or more warps at the edge might be thicker and/or of another fiber and make-up, outstandingly different from those of the patterned section of the fabric. There might be a stripe between the line on which the pattern ends and the weft turns around the last warp: the selvedge. The color of the warps of the stripe may be different from those of the patterned section. The stripe itself might be patterned by wefts, or striped by warps of different colors.

It must be noted that what I might describe as features of a side finish, other authors might describe as features having to do with the selvedge, as Wardwell does in the quotes taken from her work in my discussion section.

16. I am grateful for the help of two staff members of the Department of European Sculpture and Decorative Art, The Metropolitan Museum of Art: Melinda Watt provided the initial reference, and Robert Kaufman updated the information on the painting using the Uffizi's web site. I also wish to acknowledge Sharon Herson for providing a more detailed description.

17. A set of warps or wefts can be hidden in simple and compound weaves. A simple weave is defined as having one set of warps and one set of wefts. If threads of a set of warps are placed very close together, the set of wefts is hidden, as is often the case in satins. If warp threads are spaced wide apart, wefts can be made to cover the set of warps, as in the standard tapestry technique. A compound weave is defined as having more than one set of warps or wefts. For example, in techniques such as *taqueté, samit, lampas,* and *velvet*, a set of warps or wefts is more or less hidden. *Taqueté* is a term used by CIETA (Centre International d'Étude des Textiles Anciens, Lyon, France) that for about four decades centered in the twentieth century was called *weft-faced compound tabby*, or plain weave, and in the second half of the 20th century, *plain weave with complementary wefts and inner warps*. *Samit* is a term used by CIETA that was called in the same periods *weft-faced compound twill* and *twill with complementary wefts and inner warps*. In a *taqueté* and a *samit*, there are two sets of warps: the set of inner warps (the warps that are lifted to make pattern) is hidden, and the set of structure or binding warps is minimally exposed. In these techniques it is the wefts that dominate (Burnham 1980, pp. 172, 180). In a *lampas*, the wefts of the foundation weave are often not visible, and, to a lesser extent, neither is the set of warps of the supplementary weave. It is the set of warps of the foundation weave and the set of wefts of the supplementary weave that dominate. In *velvet*, the foundation weave—its warps and wefts included—is hidden by obviously dominant pile. Areas of the foundation voided of pile are not hidden, unless covered by a set of covering or facing wefts.

18. Clearly illustrated in color, this piece (1996.286) has a striped finish of the type described earlier (Metropolitan Museum 1997, p. 19). Daniel Walker, Curator of Islamic Art, The Metropolitan Museum of Art, graciously made the silk available. The foundation weave of the lampas is a 3&1 S-twill; the supplementary weave with metallic wefts is a 1&2 Z-twill; there is an interlaced connection; the warps of the foundation weave are single; the metallic wefts of the supplementary weave are used singly. One other feature is consistent with lampas I have noted to be "Eastern": the four foundation warps between warps of the twill are the warps that form warp pattern steps.

19. This raises the general issue of how the wefts of the supplementary weave of a lampas turn at the selvedges. Variations in how they turn are important in discussions by Wardwell (1988–89). Nevertheless, the specifics of how the wefts in the supplementary weaves of lampas turn, in terms of the mechanics of looms covering wide geographic and time spans, have yet to be outlined.

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Appendix

Thread Counts

It was not possible to note the technical features of the warps and wefts for all the pieces mentioned in this study. In general, warp and weft counts per centimeter vary within a narrow margin, as exemplified by textiles in Cooper-Hewitt:

	1896–1–59	1902–1–385
non-pile warps	42	45
pile warps	14	15
sheds of plain weave	17	19
pairs of gold wefts	17	19
pile rods	9	10

Thread Make-up

Lampas/velvets in this study which were examined sufficiently to determine technical features shared the following:

- Foundation warps have a firm Z-twist; those for pile are paired.
- Warps of the twill have a firm Z-twist and are slightly thinner than foundation warps.
- Foundation wefts have no apparent twist.
- The gold wefts, used in pairs, are made up of narrow strips of gilded animal material wound Z around a silk thread with a Z-twist, with the strips almost completely covering the silk thread.

Contour Edges of Disks

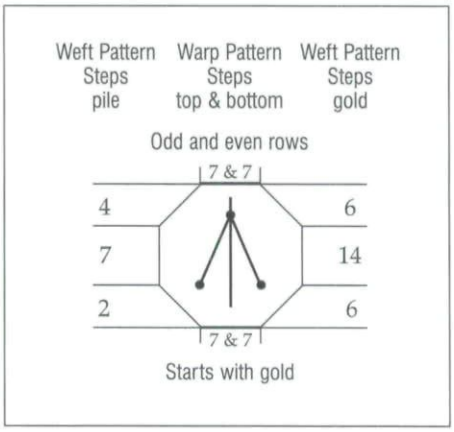
The diagrams that accompany each summary can be interpreted as follows. Each octagon is outlined. Top and bottom horizontal edges are highlighted, and their width is noted in terms of warp pattern steps. Horizontal lines to left and right of an octagon indicate its three sections with the number of weft pattern steps of the void indicated on the left and those of the gold disk indicated on the right. If a pattern shed for gold or a voided pile row starts the disk, it is so noted. It is understood that a voided pile row always ends the disk at the top and therefore is not noted. Disks that are mirror-imaged are identified by a solid vertical in the center of the octagon flanked by Z-and S-diagonals. Those disks that are repeated in the straight manner are indicated by a Z-diagonal in the center of the octagon. If a

disk can be divided in half horizontally and if it might have had a fixed or hand-selected pattern, it is so noted at the left of the abstract octagon. The diagrams indicate the generally uniform height of disks of the pieces they represent with height measured in terms of weft pattern steps.

The following summaries include information that is necessary for a discussion of repeat units and repeat systems. This includes what the repeat system might have been, where axes of mechanical mirror-imaging fall, and whether or not pattern selection might have been fixed. Unfortunately, the abstract octagons do not show differences in the contour of voids and gold disks. The importance of contour in determining repeat units and repeat systems is explained in the summary of the second example, Cooper-Hewitt 1902–1–385.

Cooper-Hewitt 1896–1–59

Seven rows studied: two odd, five even. All voids and gold disks have the same number of weft pattern steps and no major differences in disks were found. A mirror-imaging system can be proposed. Axes fall on a warp pattern step. Pattern sheds might have been fixed. If disks can be divided in half horizontally, the fixed pattern sheds could have been used in reverse order with some flexibility: the lower and upper thirds are not exactly the same, no doubt to make sure that the top edge of the disk is a voided row and that the resulting gap is covered by the overhanging pile of the next non-voided row or first full row of pile of the narrow horizontal band between rows of disks (fig. 19).

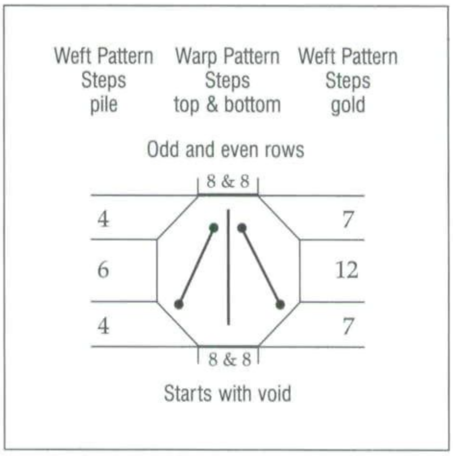


Cooper-Hewitt 1896–1–59

Mirror imaged
Axes on a warp pattern step
Horizontal center line?
Fixed pattern tie-up?

Cooper-Hewitt 1902–1–385 (fig. 1)

Six rows studied: three odd, three even. All the voids and gold disks have the same number of weft pattern steps as indicated in the accompanying diagram. Contours of voids and disks are the same in two odd and three even rows—the basic disk shown in figure 21. Disks in two odd rows are different. In one, the upper third of the void is different (fig. 22). In another, the top of the void is yet again different (fig. 23), and the top third of the gold disk is different (fig. 24). A mirror-imaging system can be proposed. Axes fall between warp pattern steps. Pattern sheds were probably selected freehand.

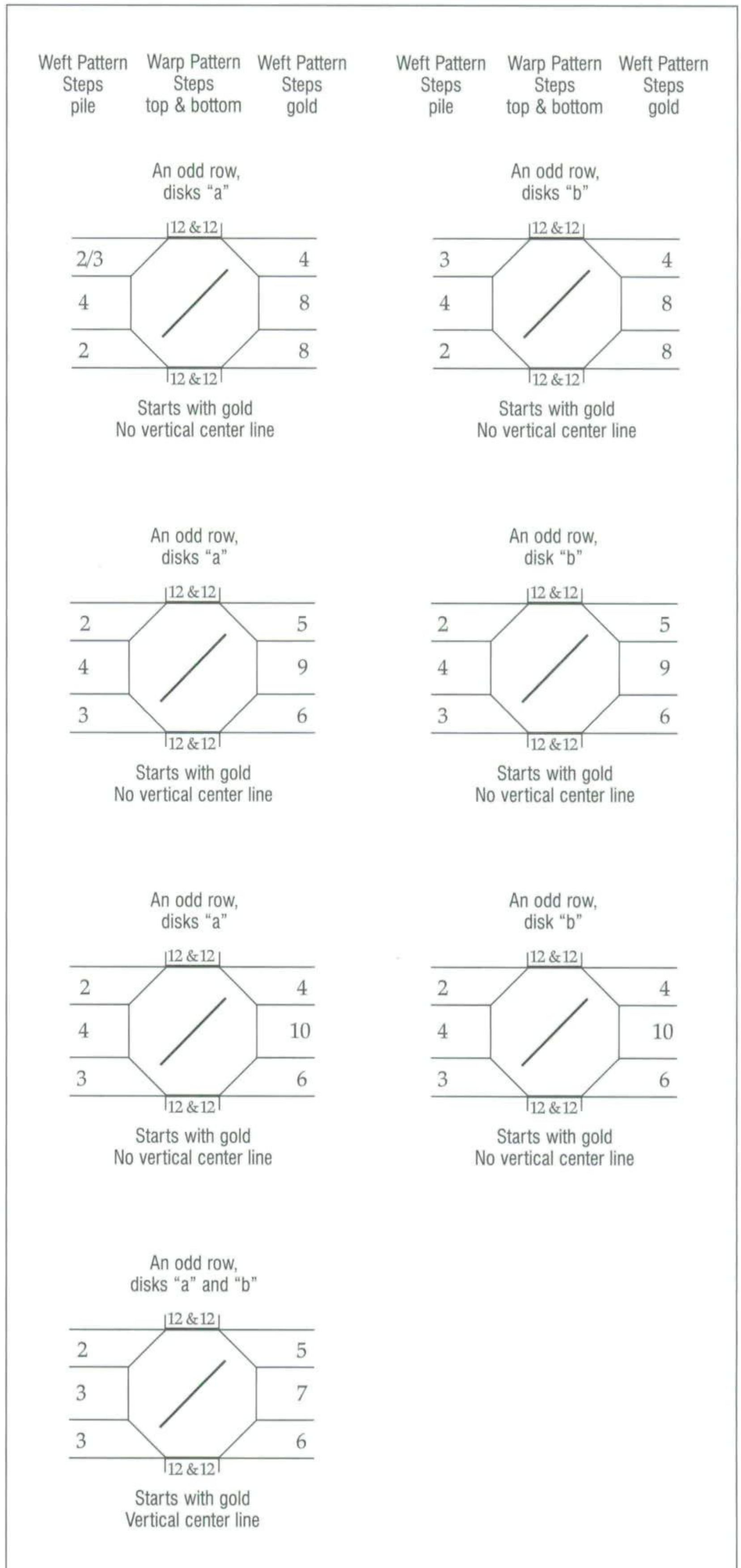


Cooper-Hewitt 1902-1-385

Mirror imaged
Axes between warp pattern steps
No horizontal center line
Free-hand pattern selection

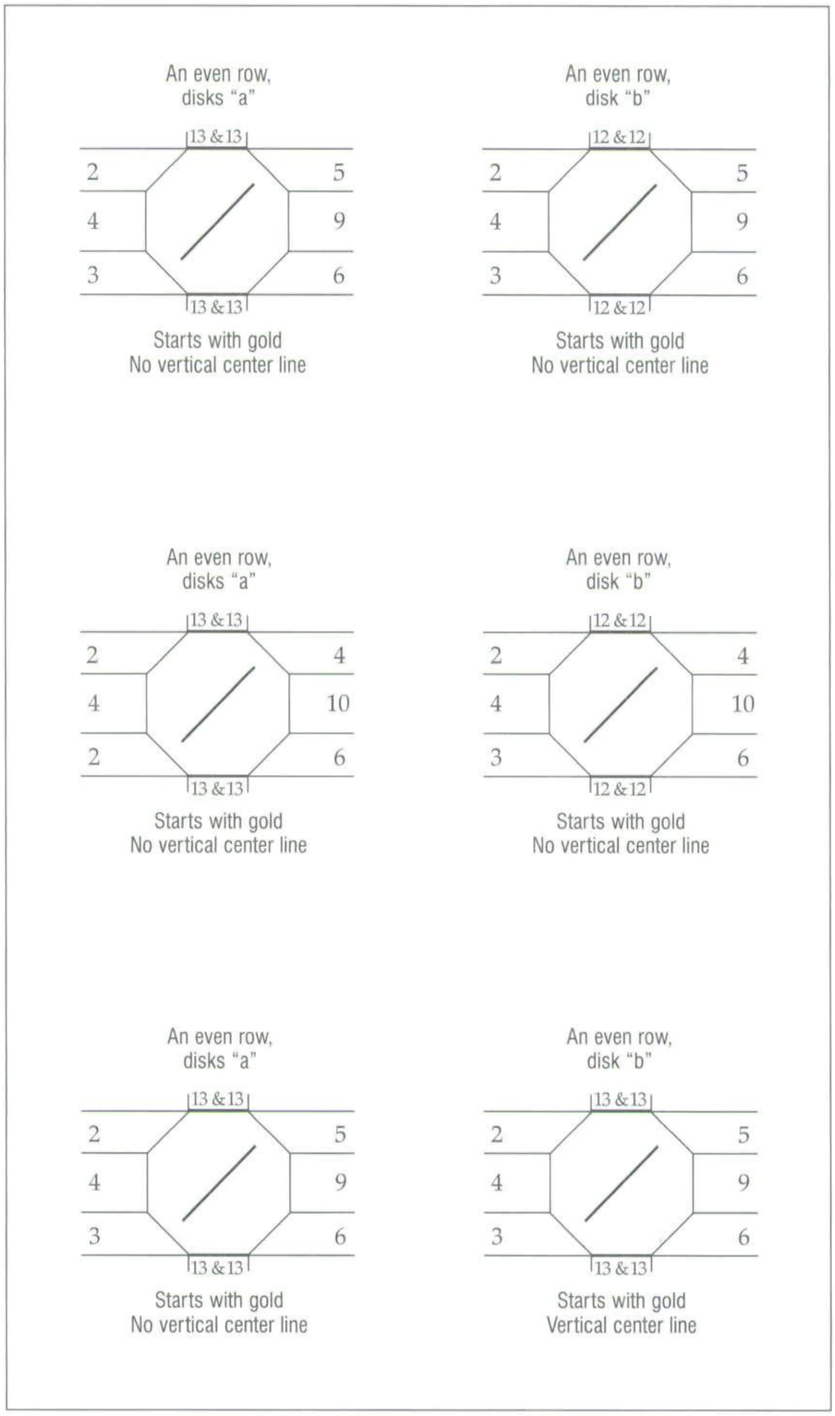
Cleveland Museum of Art 1918.30a

Seven rows were studied: four odd, three even. Disks in all rows alternate "a"/"b". Three odd rows are different and the fourth appears to be a duplicate of another but lacks one pile and two gold pattern sheds. Two even rows appear to be the same and one is different. A straight repeat can be proposed. In even rows the lower and upper horizontals are off-center but the 20 warp-pattern-step wide middle section is centered. Despite the variation from disk to disk in the number of weft pattern steps in three sections of the disk, the total number is fairly uniform. This is a good example of the minor differences one can expect in a straight repeat. The pattern was undoubtedly selected freehand.



Cleveland Museum of Art 1918.30a

Straight repeat
No horizontal center line
Free-hand pattern


An even row,
disks "a"
13 & 13
2
4
3
5
9
6
13 & 13
Starts with gold
No vertical center line
An even row,
disk "b"
12 & 12
2
4
3
5
9
6
12 & 12
Starts with gold
No vertical center line
An even row,
disks "a"
13 & 13
2
4
2
4
10
6
13 & 13
Starts with gold
No vertical center line
An even row,
disk "b"
12 & 12
2
4
3
4
10
6
12 & 12
Starts with gold
No vertical center line
An even row,
disks "a"
13 & 13
2
4
3
5
9
6
13 & 13
Starts with gold
No vertical center line
An even row,
disk "b"
13 & 13
2
4
3
5
9
6
13 & 13
Starts with gold
Vertical center line